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THE PRACTICAL TEACHER

WINCHESTER:
STATUE OF KING ALFRED

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·VOL· XXVI No 12

EDITORIAL, PUBLISHING AND ADVERTISING OFFICES OF "THE PRACTICAL TEACHER"
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THE

PRACTICAL TEACHER

A MONTHLY MAGAZINE AND REVIEW FOR THE SCHOOL-ROOM AND THE STUDY

Vol. XXVI. No. 12. JUNE, 1906. Price 6d.

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"The Practical Teacher" may be ordered of any Newsagent or Bookseller, or at any Bookstall, in the United Kingdom or in the Colonies. Supplies are sent monthly to the chief towns in Australasia, South Africa, and India.

London Office: 35 and 36 Paternoster Row.
Edinburgh Office: Parkside Works.
Dublin Office: 17 Talbot Street.
New York Office: 37 East 18th Street.
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All literary communications should be addressed to the Editor, Office of "The Practical Teacher," 35 and 36 Paternoster Row, London, E.C.

Remittances, Cheques, Post-Office Orders, etc., should be made payable to Thomas Nelson and Sons. Advertisement rates on application.

EDUCATION IN PARLIAMENT.

THE second reading of the Bill. That phrase has a familiar sound. Since 1895 the House of Commons seems to have been always reading a second time, or trying to read a second time, an Education Bill. So much the better for the House; so much the better for Education—perhaps.

But this time is a time with a difference; the second reading has resembled no other Education Bill second reading within the memory of man. It has been a mild performance. The various sections of the House have come nearer together on the question than ever before. The Unionist Party have been less fierce against this Bill than the Liberal Party was against the Bill of 1902. The Irish Nationalist Party have stated the Roman Catholic case with pathos and moderation to the serried ranks of listening Nonconformists, who gave appreciative murmurs of sympathy, and even now and then of applause. The Labour Party—the Independent one—having put its predilections for a secular system very forcibly, logically, and cogently, by the mouth of Mr. Ramsay Macdonald, subsided into silence; which last, in the case of that party, was an unusual and remarkable thing for it to do.

Christians in the House have collectively shown more Christianity this time than ever before, and the Jewish case, like the other exceptional cases, has been debated in a tolerant spirit. Listening, one has begun to doubt if ever the fires of Smithfield flared with sickening fuel—if ever men were hung, drawn, and quartered in the name of God. And one has asked oneself, Why is this? What is the cause of this unwonted moderation all round?

Of course there have been exceptions—the party spirit has blazed up now and then—on the one side now, on the other side presently: "E'en in our ashes live their wonted fires." A good deal had been done to fan those embers. Archbishops of England and Rome, Prelates of Anglicanism and Deans of Dissent, have sought to bring not peace, but a sword against the Bill. Thousands of petitions against it had come in from parishes; fulminant resolutions against "facilities" and "extended facilities" had been passed by bodies of Nonconforming laymen and divines. Roman Catholic London had crowded the Albert Hall. Lancashire Churchmen had threatened a march on the metropolis, and timid members of Parliament, as they crossed to the Palace Yard each day, looked round for the beginnings of riot in Parliament Square. Then came in the second reading, like a lamb.

Now why? What is the explanation? Perhaps it can be found in that very Cowper-Temple teaching in the schools which so many critics of the Bill decried. Not that very many of the members have enjoyed the benefits of "Board School religion." No, but it has not gone on for thirty-five years without producing its effect outside. Its effect on popular opinion, that is; the effect that millions of people consider—many of them knowing from personal experience—that a common base for Christianity can be found, and believe a Bill which proposes to extend and regularise "Board School religion" cannot be properly called an irreligious or a "Birrelligious" Bill. The drum ecclesiastic has beaten in vain, therefore, and the members of the House of Commons realise that the laity have not rallied to its roll. On the other hand, the men in the streets do not consider that a Bill which affords "facilities" and "special facilities," limited to children whose parents desire definite dogmatic instruction, is a Bill which concedes to the Churches—the ancient and historic Churches—too much; what Mr. Yoxall called a "delicate balance, almost equilibrium," seems to have been obtained in the Bill, as Dr. Macnamara in a brilliant speech made quite plain.

Members of Parliament therefore, whether Unionist or Radical, Church of England or Nonconformist, could not but know that their respective supporters, the voters, were not, as a rule, or by anything but a minority,

averse to the proposals of the Bill. Hence the roaring "gently as any sucking dove." Hence the luck of the Government with the second reading debate.

When the Parliamentary Secretary to the Board of Education said that no man of long experience in Parliament could fail to be surprised at the mildness of the warfare, he spoke true. And this is bound to have effect on the course of the Bill in the House of Lords. Had the second reading debate been stormy, had Roman Catholics and Protestants fought in an Ephesian style, had the official Opposition been as strong and bitter as the last official Opposition was against the 1902 Bill, the Peers would feel themselves justified in killing the Bill straight off. As it is, a good many considerations will go to the making up of the hereditary legislator's mind.

One of the features of the four days' debate was constant reference to the teachers. Gratifying indeed for teachers present in the galleries must it have been to hear the full acknowledgment, the frequent testimony, and the common assumption that the teachers were the keystone of the educational arch. Practically everybody said or implied that the teachers could be trusted with religious education, that nobody else could give it so well, that in the Board and Council schools the teachers had discharged their trust with discretion, offending the particular creed of none, and imparting the Christian creed of all. Mr. Evelyn Cecil, indeed, alleged that there was a case in which a teacher, being asked if the Incarnation were true, said to the child, "You can believe it if you like—I don't," but even the least talented of all the Cecils did not say that this teacher was typical, or even one of many. Emeritus Professor Butcher pointed to what he thought a danger. The Bill gives teachers the right to abstain from giving religious teaching of any kind. "It sets up a Conscience Clause for teachers," as Mr. Yoxall said. "Well, then," says Professor Butcher in effect, "suppose the National Union of Teachers decides that the giving of any religious teaching is a test, and recommends its members not to teach religion!" Chaos, stoppage of all religious lessons—of Bible-lessons, even —would, the Professor thought, ensue. Tributes, direct or implicit, to the power of the National Union of Teachers were not few, and there was much willingness to hear what the two members of Parliament (no longer three, alas!) who are members of that Union thought.

The level of oratory throughout the debate was kept at a singular height. The palm must be awarded to the Irish speakers, Mr. T. P. O'Connor, Mr. Dillon, and Mr. Healy. Seldom has any House of Commons been so affected as was the present House by the powerful, rapt, and moving close of Mr. Healy's speech. "It is easy for us to speak with emotion," he said, "and I wish to avoid a parade of religious belief. But"—he paused—"this I will say. I would rather my children should learn the 'Our Father' than that they should be taught the use of the globes; I would rather they should be prepared for the eternity to come, than be successful and prosperous in this life. I do not think much of your education. I am an ignorant man myself. I cannot spell. I could not parse an English sentence. I do not know the rule of three. I am supposed to know a little law, but I daresay that is a mistake. But, Mr. Speaker—I do believe—in—Christ—to—come!" The deep note, the high appeal, such a peroration, the atmosphere which enables it to be heard, and the feeling which it creates, form surely the rarest of those unforgettable moments which sparsely dot the aridity of Parliamentary debates. They have not been few in this debate. A softened, a more friendly, a truly Christian feeling has pervaded most of it. The official Opposition (bound though they were to oppose) did not care to try very hard to stem the general current of opinion. It was this atmosphere which led Dr. Macnamara to propose that the special facilities should be secured by statute and not left to local option. It was this extraordinary *rapport* between representatives of the most opposite Churches which caused even Mr. Chamberlain's declaration of preference for a secular system to fall flat. A new, unexampled, and wonderful *rapprochement* of hearts and minds caught up the debate; members were touched to fine issues; out of the fulness of the heart came the speeches, and the listeners heard with a catch in the breath which betokened hope. The Millennium did not come, of course—the Committee stage of the Bill will show that it is not even arriving—but for the time there was something very much like a truce of God.

For nearly the last hour before midnight Mr. Birrell held the House under the charm of his wisdom, wit, and unexpectedness. Then came the division, and the Bill was read a second time by a majority of 206. That is some thirty less than the majority at the second reading in 1902, and by the same proportion at least the Bill of to-day is inferior in moment to the Bill of five years ago. To an impartial mind, Mr. Balfour's speech, which preceded Mr. Birrell's, clearly showed how great and wise an Act was that of 1902, considered as a measure of reform and charter for Education. But the present Bill is complementary and consequential to that. The two together will (if the latter passes) set the feet of child and teacher fairly on the high road.

Additional Training Colleges for London.—On one occasion a London teacher was conversing with a friend in a certain woollen manufacturing town in France, and to give him an idea of the size of London he said that if every man, woman, and child in that town were turned into a teacher there would not be enough to staff the elementary schools of London. Some interesting figures on the number of teachers required for the schools of London have recently been presented to the County Council by the Education Committee. The number of children on the books of the Public Elementary Schools of London is 757,522. If therefore it be considered that each teacher, whether head or assistant, and whatever his status under the Code, should be responsible for a class of 45 children, no fewer than 16,834 teachers are required. Assuming that two-thirds of these are women and one-third men, we require 11,222 women and 5612 men teachers on the staffs of the London schools. If we assume that the average professional life of a teacher is ten years in the case of a woman and nineteen in the case of a man, then 1122 women and 295 men, or 1417 teachers in all, are required to make up the annual wastage. Allowing 83 as the number required for the new schools opened each year, we get 1500 as the number of new teachers required every year. The training colleges within the county of London produce 915 teachers annually, and assuming that these are all placed in London there is a deficiency of 585, which proves the urgent need of additional training college accommodation. In addition to the new college to be opened at Avery Hill it was proposed to establish a training college for 200 students in the north-east of London, and a sum of £6500 was voted to secure the site.

THE FRENCH ELEMENTARY TEACHER:

SOME THINGS HE CAN TEACH US.

BY BENJAMIN DUMVILLE, M.A., L.C.P.

THE title of this article might lead one to suppose that the writer considers the English teacher inferior to his French colleague. It will therefore be well to state at the outset that after two years' travelling in France and Switzerland, visiting schools of all types, the author of these papers is of opinion that the English elementary teacher is *at present* without a rival. What he *will be*, under the changing conditions, remains to be seen, though many of the more experienced of our primary experts have their own *à priori* opinions already formed.

It by no means follows that we have nothing to learn from our foreign *confrères*. And it is the object of this and succeeding articles to deal with some of the points which should commend themselves to the notice of the English teacher.

One of the first things which strike one in the organisation of the French elementary school is the regulation that no corporal punishment of any kind is permitted. In France they are great on the dignity of the child; and even the most harassed teachers are somewhat horror-struck at the idea of legalised caning. It has passed out of their customs, and it seems hopeless to attempt to revive it. But the keen observer can detect indications that the old *régime* has not entirely disappeared. In spite of assurances of the complete absence of blows, one cannot help wondering why a boy throws himself into the familiar attitude of defence when his teacher "pounces" upon him after a fault has been committed. Shutting our eyes, however, to these peccadilloes, we may affirm in general that corporal punishment is a thing of the past.

Now the classes are of much the same size as in England. And certainly French boys show no signs of being more quiet and orderly than young Anglo-Saxons. It is interesting, therefore, to inquire by what means the French teacher contrives to control his class.[1] If we in England are not in agreement with the French as to the advisedness of abolishing all corporal punishment, we are at any rate certain that the less there is of it the better for teacher and taught.

One of the ways in which the French teacher gains command over his pupils is by becoming acquainted with their parents. In most cases he can give you exact details of the father and mother, their mode of life, and the home circumstances of the child. He has, therefore, more data on which to go in his treatment of the pupil than is often the case with the English teacher.

The relations between parent and teacher are maintained by means of frequent and regular reports on the conduct, work, and progress of the child. In all French elementary schools each scholar is provided with a report book, which is made up at least once a month, in some cases every fortnight. Usually each mark is expressed by a number, the scale being:—

10	Perfect.
9	Very good.
8, 7	Good.
6	Fairly good.
5	Passable.
4, 3	Mediocre.
2	Bad.
1	Very bad.
0	Worthless.

The following is an example of the form of report used in the schools of Paris:—

Division..... *Class*.....

MONTH OF JANUARY.

1ST FORTNIGHT.	Number of times absent.	Number of times late. .....

Conduct in school.	Work in school.	At home: Lessons learned.	At home: Exercises written.	Weekly examinations.	Position in class out of .... pupils
				in ..... in.....	

General mark for the fortnight:—

Remarks:—

Parent's Signature. ..... Signature of Head Teacher. .....

There are similar tables for every fortnight of the school year.

In the Practising School attached to the Training College of Paris another form of book has been devised. This contains similar fortnightly reports, but in addition we find a general summary of the marks for the year, and also a kind of "barometric chart" of progress, on which a "curve" is plotted out fortnight by fortnight, as shown on next page.

At the beginning of the book are printed full instructions to parents with respect to the regulations and organisation of the school, nothing being omitted which can evoke interest in the school and its scholars.

Some books go further, and abound with practical maxims to both children and parents. Thus, under the heading "Reflections of a Good Pupil" we have such thoughts as the following:—

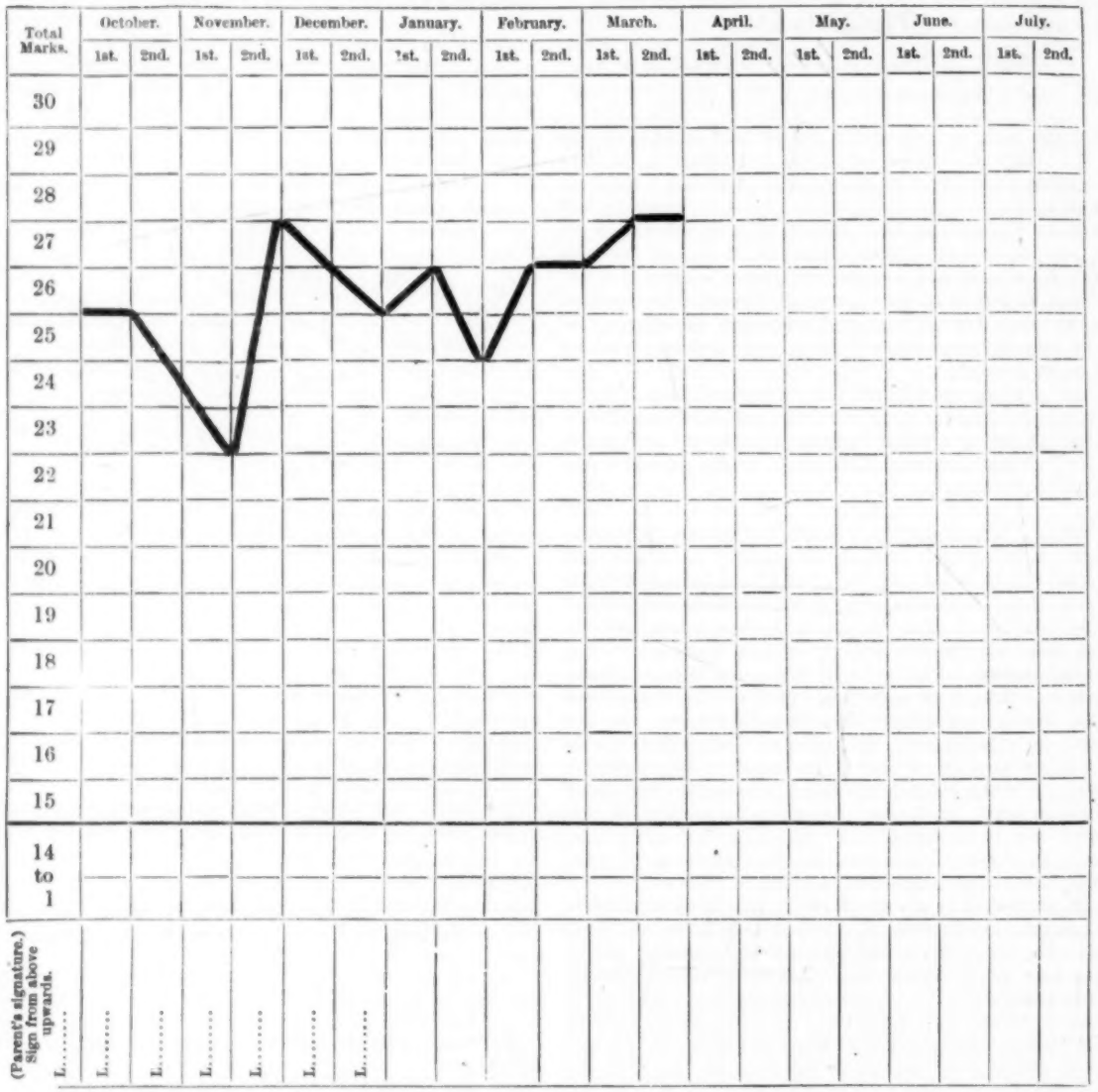
"This booklet will contain my life as a scholar during a whole year.

"Each month my master will write in it the marks which I have merited."

. . . . . .

[1] It is not to be inferred that the French teacher is highly successful in maintaining discipline without corporal punishment. In a further article we shall deal with his failings. But we are here endeavouring to take the most favourable view of his work.

What I have been Worth up to the Present Time.



"I desire to be submissive to my master, because he replaces my parents and because he is for me an affectionate and enlightened guide."

. . . . . .

"And if, in a moment of thoughtlessness or of discouragement, I should have forgotten some of these wise resolutions and deserved bad marks, I would seek to repair my fault by redoubling my good conduct and application."

"To Parents" we get:—

"You have nothing dearer in the world than your child.

"You want him in after life to be a useful, honest, and good man.

"Who wills the end, wills the means.

"The difficulties of life do not permit you to bring up your child by yourselves.

"You have called to your aid a highly educated and devoted man: *the teacher*, who will be a valuable help to you.

"You are going, then, you and he, to collaborate in the same work, and for that, it is necessary that you should come to a mutual understanding, it is necessary that your purposes should be in agreement."

Then, after information as to the use of the report-book as a means of securing the desired co-operation, the recommendations conclude:—

"And, proceeding thus hand in hand with a man who has your confidence, you will be sure that your child is being really brought up, in the best sense of the word, that is to say, *well brought up*."

Not content with sending fortnightly reports to the parents, some teachers give also a weekly appreciation. Thus a teacher in Lyons has an indiarubber stamp

with which he makes an impression at the end of each week in the exercise-book of every pupil. The following is an example of such a report:—

Month of October, 2nd Week.

Conduct	10 marks
Written exercises . . .	4 ,,
Lessons learned . . .	24 ,,
Examination	10 ,,
Total	48 marks

Position, 2nd out of 16 pupils.

Some will go even further, and ask the parent to initial the exercise-book (which has been duly marked by the teacher) at the end of each day's work. It would appear, however, that even in France, where parents take more interest in their children's education than in England, it is too much to expect three minutes' attention per day to the child's school work. There, as with us, a great deal is expected of the teacher, but the parent's duty is still insufficiently emphasised.

The reports are further supplemented by a system of cards and tickets, awarded for good conduct and work. These render the marks more tangible to both scholars and parents, and have considerable effect, especially with the lower classes. They are of three grades—the "good mark" (*bon point*), the "testimonial of satisfaction" (*témoignage de satisfaction*), and the "honourable mention" (*mention d'honneur*). The "good marks" are small tickets given during school-time for an excellent piece of work, an intelligent reply, exceptionally good conduct, and so forth. The "testimonials of satisfaction" are larger cards, usually given at the end of the week. They represent either a certain number of the smaller ones (often ten) for which they are exchanged, or general excellence in lessons, exercises, &c. The "honourable mention" is a still larger card, and often represents a certain number of the "testimonials." All these cards are printed and are usually supplied by the local school authorities. By them the parents have a further means of knowing whether their children are giving satisfaction. In some schools, all the little boys in the lower classes who work well are presented with a "good mark" at the end of each session. The parents, if they are keen, will expect the small ticket every time the child comes home from school. Often, instead of plain cards, coloured pictures are given in exchange for a number of the small tickets at the end of the week. They are usually of some educational value, representing geographical subjects, various animals, different processes in the arts, and the like.

At the end of the school year, all marks are added together, and the annual list is made out. This usually depends partly on good conduct and industry, partly on native intelligence. For the marks obtained at the periodical examinations are counted in with those obtained for behaviour, home work, and school exercises. According to this list the prizes are given. The number is exceedingly large, nearly all the boys receiving a prize of some value. Only the worst are excluded. The Annual Prize Distribution is a much more important function than in most English elementary schools. The public men of the district attend in force, many speeches are delivered, and large numbers of the parents are present to witness the honouring of their children. If it appears ridiculous to lavish prizes on so many of the pupils, it must at any rate be recognised that by this means the interest of the parents is aroused and a new link is forged between school and home. In most schools, books are the usual prizes. In some, the form taken is the addition of small sums to the deposits of scholars in the savings bank.

Most schools are provided with an honour board (*tableau d'honneur*). This, however, is not for recording the successes of the older pupils, but for honouring all deserving scholars during their work in the school. The names of those worthy of mention are put up at stated periods—usually every month. Little spaces are provided into which the names, written on small slips of cardboard, can be inserted. Here, once again, the French may be charged with utilising and developing too much the instinct of emulation. The influence of the Jesuits' schools, which have survived in France in much greater numbers than in England, is still keenly felt, and some of their methods are even now to be found in the secular schools.

A further means of getting into close touch with the boys is provided by the "*garderies du jeudi*." Thursday is the holiday corresponding to Saturday in England. In most of the towns, the teachers take charge of those children whose parents care to send them, during the whole afternoon. (Those who undertake this do so of their own free will, and receive extra remuneration which is at a more liberal rate than their ordinary salary. No loss of appreciation appears to be suffered by those who, on account of other occupations, decline this work.) If the weather is bad, the children remain in school and amuse themselves in various ways under the direction of the teacher. When it is fine, walks are taken into the country or to the parks, and open-air games are played. Sometimes visits are made to museums and places of interest. On such occasions as these, when free and untrammelled intercourse is possible, the teacher gets to know his boys much more intimately than he is ever likely to do during the ordinary school work.[1]

In each class there is what is known as a *cahier de roulement*. This is an exercise-book similar to that in the possession of each scholar. It is kept a whole day by each boy in turn. In it he writes all the exercises of the day, instead of using his ordinary book. At the end of a few weeks it contains not only specimens of all the exercises done during that time, but examples of each boy's work. It is thus extremely useful for the inspectors, who can from it obtain a good idea of the work of the class. But, in addition, it has an effect on the general work of the boys. The scholar who holds it for the time being feels a certain degree of responsibility. He has to some extent the honour of the class in his hands, and feels bound to do his very best. The teacher can use it as a lever to move the boys to more care and diligence in the writing of the ordinary exercises.

Each boy has also a *cahier de devoirs mensuels*. Once a month an ordinary exercise is written in this book instead of in the usual exercise-book. Different sub-

[1] The evils attendant on too close and too prolonged companionship with the boys will be dealt with in a subsequent article.

jects are set each time, and no additional help must be given. The pages are numbered, so that what is once written cannot be removed and replaced. While it is difficult to detect progress from day to day, it should be easy to discover it from month to month. By means of this book, then, the boy can trace his progress throughout his school life. The advances that are made, being thus clearly shown, are a source of encouragement to the boy, and at the same time furnish a means of control to the teacher and the inspector.

The monthly exercise-book used in Lyons contains, among the instructions printed on the cover, the following recommendations, which bring out still more clearly the object of the book:—

> "Child! work in such a way as to be able one day to look upon this abridgment of your school life without having to blush! It is not indispensable that you should be one of the first pupils in the class; the advantage of this book is precisely not to compare you with your comrades, but to compare you with yourself at different stages. It is not a question of showing whether you are more intelligent, more clever, more learned than some other pupil, but of indicating each year, each month, whether you are more clever, more learned than you were some time before, whether you have learned to do better to-day than you did yesterday, whether you will try to do better still to-morrow than you have done to-day."

It is not intended in this place to go into the details of the moral instruction which is given independently of the Bible.[1] One point in it, however, may be mentioned. Every morning a maxim is written on the board. It is explained and driven home by the teacher, and the boys write it in their books as the commencement of the day's work. The following are some examples of these maxims:—

> "Of what virtues would you be capable, if you did not commence by loving your mother?" (*Socrates*).
>
> "Every conquest engenders two servitudes."
>
> "The lazy are always wanting to do something; but they never do anything."
>
> "It is necessary to help one another; this is the law of nature."
>
> "The well-educated workman has always several strings to his bow; if one breaks, he puts in a new one and the bow is still stronger."

All these elaborate and varied arrangements for stimulating the pupils to diligence and good conduct have not been described as perfect models for the English teacher to copy. The intention is merely to suggest lines of action which have been somewhat neglected in English elementary schools. The teacher of the past, under the cast-iron system of payment by results, might have been excused for hastily seizing on the nearest instrument at hand to enforce his authority and to keep his pupils at their work. He was in a position analogous to that of the primitive savage who, being at the mercy of the great forces of nature, and requiring prompt action to save his very existence, felt himself bound to accept the first explanation which suggested itself and to act upon it. Now, however, things have taken a turn for the better. Teachers need no longer be harassed by the dread of an inspector with his inexorable machinery of examination. The new inspector requires thought behind the work, and the teacher has leisure, if he will but avail himself of it, to look round and search for those methods which, though they may not bring the coveted cent per cent of passes, are, at any rate, educationally sound.

In visiting a large number of French schools, one cannot fail to notice a striking structural difference between the French and English classrooms. In the former the blackboard is usually much larger than in English schools, and is fixed to the wall facing the class. Before it is a large platform with the teacher's desk at one end, so that all the space in front of the board is free. The platform is of such a height and the board is so arranged that the children can easily write upon the latter in full view of the class. We also have fixed as well as movable boards in many of our English schools. But they are usually high, and intended only for the teacher. This difference points to an important variation in general procedure. It may be said that the English teacher makes too much and too little use of his blackboard. He writes too much on it himself, but seldom requires his pupils to do so. In good French schools the teacher is continually calling out boys before the class to work sums or to write from dictation on the board. Many of his scholars become excellent manipulators of the chalk. During these exercises the teacher can sit and control the work, at the same time giving an eye to the class. Who has not felt the difficulty of keeping the attention of the boys while writing on the board? By setting some of the scholars to write upon it, the attention of the class is increased in a twofold way—

(1) by the added interest which the scholars feel in following the work of a comrade;

(2) by the fact that the teacher's eye is upon them.

The energetic young English teacher is too apt to imagine that the more he does himself the better will be the result. The criterion of good teaching, however, is not the spent teacher, but the alert scholar; and, *cæteris paribus*, the best teacher is he who, with a moderate amount of exertion, secures a maximum of mental activity from his boys. Let us, then, learn this lesson from the French teacher. The writer has seen many an excellent lesson during which the teacher has played quite a secondary part, confining himself to quietly directing the work of various boys at the board. It is possible for a good day's work to be done without any undue strain on the part of the teacher. In these days, when so many teachers complain of the trying nature of the work, too few of them have employed their intelligence to discover methods by which they can ensure keen attention from the boys without enormous exertion on the part of the teacher.

Objections will certainly be raised to advice of this kind. Some teachers will say that the head master will hardly be satisfied to see his assistant quietly looking on while the boys do the work for which he is paid. First of all, it must be remembered that all the teaching will not be of this character. Lessons breaking new ground must be given almost entirely by the teacher. Further, all head teachers are not so unreasonable. The old-time pedagogue, who considered it impossible for good work to be done unless the teacher were on his feet and talking the whole time, is rapidly giving place to a more intelligent type. Inspectors, too,

[1] This teaching will be criticised later.

are beginning to see that energy is not necessarily a synonym for efficient teaching.

It must, however, be admitted that this is a serious objection; and for this reason the writer would earnestly commend these thoughts to head teachers and—dare he add?—to inspectors. He well remembers a practice he had with a backward Standard II. of breaking up the class into five or six small sections for the latter part of the reading-lesson, each division being in charge of one of the sharper pupils. The idea was to get as much practice in individual reading as possible. The teacher passed from one group to another, at the same time keeping a general look-out on the whole. On the morning of an inspection, the head teacher begged him to abstain from this practice, thinking, probably, that the inspector would have a bad impression if he found a teacher taking matters so easily. The question then, as too frequently at the present time, was not, "Are the boys doing good work?" but, "Is the teacher exerting himself to his utmost?"

Another difficulty which may be raised is that we have usually no arrangement of platform and board to enable these suggestions to be followed, and that education committees are not likely to spend money on our "fads." (Here, once again, are seen the evil results of denying all voice to the practical teacher in the important question of educational fittings.) But a very small outlay would render such work possible. Indeed, what is about to be suggested is what is actually done in some French schools where the necessary arrangements do not exist. A long stool can be constructed to place before our high boards, with a step half-way between the top of the stool and the floor. Scholars can thus easily mount and write with ease on the board.

The English teacher can scarcely be said to render the palm to his French colleague in the matter of oral questioning. But there is one form of interrogation which the French teacher uses more frequently and with more effect than his English *confrère*. It is what is called the *interrogation individuelle*. When a lesson has been learned, instead of addressing a number of questions to the whole class, the teacher will call upon one scholar to come on the platform. Here he will be asked a number of questions, requiring, according to the age and capacity of the pupils, more or less lengthy answers. A mark (maximum ten) is awarded at the end. This practice has the following advantages:—

1. It is the surest method of thoroughly testing a pupil.

2. It trains the pupil in expressing himself clearly and unhesitatingly before his fellows. In judicious hands it may lend great assistance in cultivating expression in the mother-tongue. Let us take a convenient example. Suppose the fable of the "Fox and the Grapes" has been studied in a class of young children. The English teacher is inclined to put such questions as—

> What did the fox see?
> What sort of grapes were they?
> What would the fox have liked to do?
> Why could he not do so?
> What did he say?
> What people are like this?

These questions, of course, are addressed to the whole class; and are answered by different pupils. The French teacher would perhaps call out one scholar and ask him to narrate the fable in his own words. This requires *continuity of thought and expression* on the part of the pupil; and that rare power of giving clear and connected accounts is developed. The English teacher's method keeps more boys on the alert; but all the arrangement and connected thought is done by the master. The pupils have only to supply missing links. It is, of course, necessary to employ both kinds of questioning, and many teachers do so. But the educational value of the French method has not yet been sufficiently recognised in England.

3. It is a great incentive to careful preparation; for no boy cares "to make an exhibition of himself" before his fellows.

4. If properly handled, it promotes attention; for the pupils are interested in seeing how their comrades acquit themselves.

5. If other methods of testing are employed, as they should be, it is an agreeable variation from the monotony which a stereotyped form of questioning is bound to produce.

Of course, it occupies much time, and only a few can be questioned in this way during one lesson. But, with due limits, and with frequent reversion to general questioning of the class, especially when the boy interrogated cannot answer, it forms a very valuable exercise.

BY MANY HANDS.

"Quot homines, tot sententiæ."

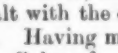
N.U.T. NOTES.

Concerning Conference.

CONFERENCE, with its multitudinous and varied functions, concluded far too late in April for any reference in my last month's "Notes"; and, although as *news*, paragraphs regarding Scarborough would be undoubtedly stale and vapid, yet a few general reflections from an old Conference-goer may prove not uninteresting. Of the fifteen consecutive annual Union demonstrations which I have been privileged to attend, three stand out pre-eminent—those of 1896, 1902, and 1906, in each of which the *pièce de resistance* was an Education Bill, introduced by the Government of the day on the very eve of Easter. The attendance throughout the sessions at Scarborough was enormous, and probably all previous "records" were easily broken. The debating—as it always is when the occasion demands—was of an exceedingly high character, and although what I fear I must describe as "party feeling" ran high, the mutual patience and forbearance were most noteworthy. A prominent Catholic teacher assured me, at the close of the public sessions, that he and his co-religionists had been both gratified and delighted with the sympathy evinced towards a very small minority of the delegates. The huge majority of "progressive" representatives used their giant strength in a fashion which left no vestige of resentment behind.

READERS of the "appreciation" of the President-Elect which appeared in the April issue of the *Practical Teacher*, will be prepared to hear that Mr. T. P. Sykes, M.A., justified the expectations and anticipations of his numerous friends, high though those anticipations undoubtedly were. His presidential address was admirably delivered, and listened to with rapt attention, for it dealt with the question of the hour—the Education Bill. Having myself had an identical experience with Mr. Sykes four years ago, I could sympathise with the man whom circumstances compelled to destroy a cherished and carefully prepared oration, in order to deal at short notice with what was in every one's mind. Mr. Sykes was, however, more than equal to the occasion, and he voiced, acceptably, the sentiments of the 57,000 members of the Union. As a chairman he was a success from start to finish. Of handsome (almost commanding) presence, and dignified, courteous, and cultured manner, he was studiously fair and just throughout, and never did minorities have a better opportunity of stating their views than at Scarborough. Possibly the "floor" caught his eye more times than did the platform, but this was all to the good, for the Executive have many chances of intervening in debate denied to the modest representative. If his rulings were in one or two instances technically wrong in the estimation of the quidnuncs, this detracted not one iota from the excellence of the manner in which all his high duties were fulfilled; and 2000 men and women returned home with the glad consciousness that for the next twelve months the honour of the Union may be confidently left in his hands. To say that his winsome wife added charm and grace wherever she went is supererogation of the most pronounced description.

The President.



THE Union's "Blue Ribbon" went, as every one expected it would, to Mr. A. R. Pickles, B.A., whose rising to say a few words of thanks, on Easter Monday afternoon, was greeted with thunders of applause. His speech, bristling with epigram (as usual), and pithy phrase, was one of the happiest efforts of a memorable week. Here are some interesting figures in connection with recent

Election Results.

V.-P. ELECTIONS

Year.	N.U.T. Membership.	Voting Papers Returned.	Number of Candidates.	Winner.	Winner's Contest.	Winner's Poll.	Winner's Percentage of Votes.
1898	38,687	29,179	3	Clancy	4th	15,506	53·1
1899	40,485	28,884	5	Jackman	2nd	7,679	26·6
1900	42,005	28,665	4	Blacker	2nd	13,711	47·8
1901	43,614	30,186	3	Croft	2nd	15,428	51·1
1902	45,123	31,494	4	Coward	3rd	16,109	51·1
1903	47,326	34,220	2	Sharples	2nd	19,302	56·4
1904	50,650	35,644	5	John	5th	16,825	47·2
1905	54,007	38,219	4	Sykes	2nd	16,046	41·9
1906	57,584	38,345	3	Pickles	2nd	25,019	65.2

Messrs. Nicholls and Blackburn, although hopelessly beaten on this occasion, polled sufficiently well to encourage their further candidature. In my April "Notes" occurred the sentence: "I do not anticipate more than *two* of the present Executive suffering defeat at the polls." As a matter of fact, *all* the retiring members who sought re-election retained their seats—a new "record" under the present system, as the subjoined table will show:—

Year.	Number to be Elected.	Number of Candidates.	Average Number per District.	Districts with no Contests.	Old Members Unseated.
1898	36	86	7·2	...	3
1899	36	58	4·8	2	4
1900	36	60	5·0	1	4
1901	36	52	4·3	2	2
1902	38	56	4·7	2	2
1903	41	59	4·9	...	3
1904	42	58	4·8	4	2
1905	44	65	5·4	2	4
1906	46	63	5·2	3	...

The new members of the Executive are Messrs. W. D. Bentliff, E. Davies, E. Ruse, A. Tutt, and J. Williams, all of whom possess a big reputation in the constituencies which they now represent.

THE Bristol precedent was naturally followed, the whole of the arranged agenda for the public sessions being at once abrogated, in order to consider the new Education Bill. Unlike Bristol, however, the discussions were not concluded, and on one vital motion: "That any denominational religious teaching in public elementary schools shall be given by persons other than the teaching staff"—possibly the most vital resolution of all—no decision was come to, owing to the time allotted to the session being exhausted. I think I never listened to a finer or more interesting debate than that on the Executive's first resolution, commending those principles of the Education Bill of 1906, under which all public elementary schools, their teachers and managers, are to be brought under complete popular control, and under which creed tests for teachers are to be abolished. This motion was in the capable hands of Dr. Macnamara, M.P., and Mr. Marshall Jackman, whilst the denominational amendment was entrusted to Messrs. Crowther (Bolton) and Fleming (Oldham), men equally eloquent and sincere, but not possessed of the same influence and persuasive power as the Executive's protagonists. The sectarian supporters were enthusiastic and demonstrative, not to say noisy; but in the end the approving resolution was carried by an overwhelming majority. Several motions were agreed to after little or no discussion, the only one to evoke a trace of opposition being that advocating a Conscience Clause in all State-aided Training Colleges. The resistance to the motion was not in the end very formidable, although two amendments had to be defeated before the main resolution was passed. In leaving the public sessions, I desire to add my quota of praise and gratitude to the Right Hon. A. H. D. Acland for his delightful speech on the opening day.

Public Sessions.

THREE private sessions were held this year, and the attendance at each was extremely large. There was the usual antagonism 'twixt floor and platform, but

it was good-humoured enough, and no one could grumble about its "tone." After being "in possession" (as it were) for twelve whole months, it probably serves a useful purpose for the Executive to be reminded that their actions are keenly watched by a band of eager and zealous critics, quick to seize on any and every delinquency of the ruling fifty. In my younger days I fairly revelled in taking sides "agin the government," and sometimes even now I am inclined to envy the delightful freedom and *insouciance* of the "coming men." The proposal to increase the salary of the General Secretary was introduced in a speech needlessly mysterious and obscure, but the pusillanimous objections raised made the ultimate acceptance of the Executive's recommendation all the more hearty. Mr. Yoxall had a veritable ovation on returning to the Conference Hall after the brief discussion was over. Mr. Marshall Jackman was allowed the abnormal period of forty minutes in which to describe the suggestions of the Executive for amending the Superannuation Act; and the close attention with which his lucid statement was followed evinced both the keen personal interest of his audience and, incidentally, how little many of them previously knew concerning the subject. The advocates of "optional" retirement were in a hopeless minority, and Mr. Jackman's proposals were agreed to almost unanimously. After Superannuation, the most important subject was "Sustentation," and so keen was Conference regarding this matter that most of the representatives were prepared to vote for the increase of two shillings per member in the annual subscription, without a word being said. But the stalwart Mr. A. E. Cook tested the opinion of the representatives only to be badly beaten, and in the end the motion of the Executive was carried, on a division, by 32,006 votes to 12,193—a majority of 19,813, which is convincing enough, in all conscience. The Examinations Board had its lease of life renewed, after exhaustive statements by Messrs. Bowers, B.A., and Shawcross, B.A., Chairman and Vice-Chairman respectively of the old Board. During the debate on this topic Mr. Ernest Gray intervened at a most opportune moment, his position on the Consultative Committee enabling him to speak with an authority denied to every one else present. The Executive have now the responsible task of appointing a new Secretary "at a salary of not more than £250 per annum," and it will be everybody's desire that the services of a thoroughly capable man will be secured.

Private Sessions.

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ONE item of business transacted during the second and third private sessions was so unusual that I give it the distinction of a separate paragraph. There was a keen discussion over the finances of the Union a year ago, and its outcome was the presentation of a Special Report to the Scarborough Conference. The recommendations of the Executive were not sufficiently drastic to suit the advanced members of the party of Reform, and eventually a Special Commission was appointed to consider both the finances and the organisation of the Union. The constitution of this Commission is as follows:—

A Special Commission.

The President	The Examiners of Accounts
The Vice-President	9 Members "elected by and from the Executive"
The Ex-President	
The Treasurer	

together with—

Mr. C. T. Breary (Hackney)	Mr. R. B. Hancock (Nottingham)
Mr. T. T. Burkett (Greenwich)	Mr. C. T. Milford (Portsmouth)
Mr. W. Carr (Morecambe)	Mr. H. R. Morrell (York)
Mr. H. M. Cohen (Birmingham)	Mr. T. M. Parry (N. Staffs.)
Mr. W. T. Crank (Bristol)	Mr. H. E. Storey (Manchester)
Mr. R. A. Drake (Queensbury)	Mr. A. S. Thomas (Chelsea)
Mr. F. B. Gale (East Dereham)	Mr. G. F. Vernon, B.A. (Finchley)
Mr. C. E. Hampton (Hull)	Mr. E. C. Wilmott (Cardiff)

The selected gentlemen will form a strong Commission without a doubt, the only criticism I have to make being the omission of any representative from N. England. On the principle, I suppose, of "*Vae victis*," Yorkshire claimed three seats, but in my humble judgment one of these might have been wisely allotted to the representation of the "Far North." Such "concentrated wisdom" as the above will produce valuable work, yet I have my doubts about their satisfying themselves, let alone the 1907 Conference. *Nous verrons!*

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ONE of the silliest things attempted during Conference week was that of foisting an additional private session on Friday morning. The argument of the very sincere sponsor of the proposition ran thus: "Last year at Llandudno much time was wasted: therefore this year we must meet on Friday"—"and waste still more time," whispered the cynic at my elbow. Remonstrances by the local officials regarding the upsetting of all the excursion arrangements were quite unavailing, and it almost looked as if the zealots would have their way, when luckily a brilliant suggestion of Mr. Coward to the effect that the final decision should be deferred until Wednesday evening carried the day. When, two days later, the representatives were again consulted on the matter, hardly a dozen hands were held up in favour of the course so hastily assented to on the opening day. I cast no reflection on the admirable and esteemed President of the Union when I say that had I been in his place I would not have accepted the amendment at all. The sessions *must* be determined beforehand, both for the convenience of delegates and the local officials; and I can conceive nothing more disastrous for the excursions, etc., than for the organisers to be in any doubt regarding their financial success. Another year the Executive will not be caught napping as they were at Scarborough.

Trop de Zèle.

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CONFERENCE would be almost tame without its social functions, and, so far as my own observation went, these were brilliantly successful at Scarborough. The Conversazione, which for the past two years has replaced the Conference Dinner, was attended by over 700 visitors and guests, who were charmed by a high-class musical programme, as well as interested and entertained by a lecture on Colour Photography. And of course there was "good talk" galore! The Ball, I understood, passed over very well, although it is becoming each year more and more a local dance only. In my younger days Conference *habitués* ministered to Terpsichore to a much greater extent than do their twentieth-century successors. The College Reunions were naturally well attended, but more successful than any of these was the "Social" and Whist Drive organised by the Non-

The Social Functions.

Collegiates. Miss Simpson and her energetic colleagues may lay the flattering unction to their souls that their bold innovation was, in the opinion of many present, about the most enjoyable function of the week. The ladies (and a few men) were received by the wife of the borough member, at the Grand Hotel, on Easter Monday afternoon, and doubtless appreciated the pretty compliment.

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I HAVE no space to allude to a tithe of the excellent speeches delivered during the week, but three of the younger men spoke with such promise that they will be heard of in the future without a doubt. Mr. Pendlebury, of Bradford, in seconding a vote of thanks to the President for his address, made one of the cleverest speeches of the week, though it was, in places, indistinctly heard. Then Mr. F. J. Cooper, of Nelson, with the face of a budding barrister and all his assurance, laid out his facts so well that I was intensely proud of my old Nottingham *confrère*. Lastly, Mr. E. R. Jones, of Rhondda, captivated both men and women by the eloquent and impressive manner in which he dealt with the Examinations Board. Some enthusiastic fellow-countrymen said that he is already referred to as "a second Lloyd-George," and I can well believe it.

Some Promising Speakers.

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I CANNOT close these "Notes" without a few words of congratulation and felicitation to the Scarborough teachers for the magnificent manner in which the Conference was organised. The local officials were undoubtedly the right men (and women) in the right place, and officers and rank and file must have worked nobly to secure the success which fell to their lot. Two thousand delegates have resumed their professional labours, convinced that the Scarborough Conference was almost the best of its kind. Next Easter we go to Oxford for the second time. Those of us who visited the fair city twelve years ago will be anxious to renew her acquaintance, whilst hundreds of others will be glad of the opportunity of treading classic ground. Hastings made so brave a bid for the honour of entertaining Conference that success will come to the Sussex elysium in less than a couple of years.

Next Year.

A. C.

NOTES FROM THE NORTH.

ON the 21st of April the election for the Gartmore School Board took place, and the result, as was confidently expected, was a complete justification of the attitude of the Institute. Three candidates favourable to the reinstatement of Mr. Menzies were returned at the head of the poll, while the Chairman of the last Board found himself at the foot. At the first meeting of the new Board notice of reinstatement was given, and so far the dismissal case in Gartmore is at an end. But the question naturally arises, how far has tenure of teachers been advanced by this case? No better example of harsh treatment could have been cited. Yet the Government has not shown any zeal in the matter. Questions were asked in the House of Commons relative to the subject, but no satisfactory answers were given. It must be self-evident that, if the dismissal of Mr. Menzies had taken place either at the beginning or in the middle of the tenure of office of the Board, Mr. Menzies would have certainly had to leave. The point in his favour was that the dismissal took place just before the election, and the feeling of the ratepayers could thus more quickly be given effect to. But there is no use of blinking the fact that tenure has not yet come within the region of practical politics. Enough pressure has not yet been brought to bear on Members of Parliament, and the sooner this is done the better.

Gartmore.

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I DO not think the Scotch Education Department has come out of this case very well. On the morning of the election (21st April) a letter was received by Mr. Menzies to the following effect:—

The Scotch Education Department and Tenure.

"SIR,—I am directed to state that my Lords have been in communication with the School Board of Gartmore in the matter of your dismissal from the office of teacher there.

"The Board have now expressed their willingness to leave the matter to the arbitration of Mr. Scougal, and on learning from you that you will be prepared to abide by his decision as to the form of apology that he may consider desirable, my Lords will instruct Mr. Scougal to take the necessary action.

"(Signed) J. STRUTHERS."

Now, considering the fact that Mr. Menzies had already apologised, and that the Department, I presume, knew the terms of this apology, and that he was willing to abide by these terms, it looks as if the Department wished to get behind the apology. Either the Department was ignorant of the true facts of the case, or it was willing to favour the School Board. Many find in the present unsuccessful interference of the Department a further argument for the removal to Scotland of the Scotch Education Department, and others are not so sure to-day as they once were that the Scotch Education Department would make a very satisfactory court of appeal. It is even hinted that there was a meeting between the School Board and H.M. Inspector, Mr. Scougal, and that, as the result of this, a form of apology was prepared, which was not acceptable to Mr. Menzies and his friends. Was this apology again to be asked of Mr. Menzies; if not, why were his hands to be tied by binding him to this previous condition of acceptance? The Department has, indeed, been dilatory, and does not come out of the Gartmore case well.

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MR. BIRRELL'S statement in introducing the Education Bill, that £1,260,000 was to be expended on English education through the financial operations of the Bill, at once aroused in Scotland expectation of another equivalent grant of approximately £150,000. At once suggestions as to the probable best methods of spending it were being heard on every side. Superannuation was, of course, the most clamant cry. But

Equivalent Grants.

it will be better not to count the chickens till they are hatched. In the past the Scotch Education Department, and the Scottish Members of Parliament, have kept a watchful eye on the interests of Scotland financially, and I trust they will on the present occasion not be found wanting. Then, again, the grant of £138,000, promised by Mr. Asquith in his Budget, for assisting necessitous over-rated communities in England, will call for an equivalent of £18,000 for Scotland. Surely Scotland will, with these grants, get a Faculty of Education. This has been long desiderated, and with this overflow of money I trust it will be found to be within measurable distance of realisation.

* * *

University Reform.

ATTEMPTS have recently been made to get our Scottish Universities into line with the needs of the present time, but it has been found that to suggest reforms was one thing, to get these reforms carried out another thing. By the Universities (Scotland) Act of 1889, it is provided that the Court of each University has power to make such ordinances as it thinks fit; but the process through which it has to go is rather a deterring one. Before submission to the Privy Council for approval, each new ordinance must be communicated in draft by the Court to the Senatus and to the General Council for their opinions thereon. After final adjustment by the Court, it has to be communicated to the Courts of the other Scottish Universities. Each of such other Universities, or any person directly affected by the new ordinance, may, within one month, notify dissent, and within another month lodge a representation with the Privy Council. The ordinance may be referred to the Universities Committee of the Privy Council for a report to His Majesty, but cannot be approved until it has been laid before both Houses of Parliament during twelve weeks of session, to give these Houses an opportunity of presenting an address praying the Sovereign to withhold assent. Could a more effective "Barrier Act" have been framed? The Business Committee of the Edinburgh University thinks such procedure slow, cumbrous, and far from encouraging in its results, and in striking contrast with the autonomy enjoyed by the lately created English Universities. The Business Committee, as the result of its deliberations, recommends the General Council of the University to represent to the University Court that the time has now come when the Government and Parliament should be asked to confer upon the Scottish Universities severally a large measure of autonomy. It will not be possible for the Universities to make the steps forward that they should until some such freedom is granted them.

* * *

The New President of the Institute.

MR. JOHN MUDIE, F.E.I.S., Glebelands School, Dundee, is the new President of the Institute. He was the only one nominated for the office, and has therefore had a walk over. After leaving the Training College, Mr. Mudie received an appointment at Stockton-on-Tees. From the first he took a great interest in matters educational, and more than thirty years ago was sent as a delegate of the Teeside Teachers' Association to the York Congress of the N.U.E.T. After the passing of the Scotch Education Act he returned to his native town, Dundee. Since his return thither, Mr. Mudie has been one of the most active members of the local branch of the E.I.S., and has done a great amount of active propagandist work. The Dundee Local Association ranks as one of the largest branches of the Institute, and its prosperity is in no little measure due to the indefatigable efforts of Mr. Mudie, who has acted as its Secretary for a number of years. In the Executive work of the Institute he has also taken a most effective part. He has been a member of several of the Committees, has been Vice-President, and has acted as representative to the Irish Teachers' Conference at Londonderry. I feel certain that in Mr. Mudie the Institute has secured a President who will devote himself heartily to its work. His administrative ability, his knowledge of business, and his geniality, will find full scope.

* * *

The Vice-President.

AS for the higher office so for the lower there is this year to be no contest: Mr. James Will, M.A., New Pitsligo, the rejected of last year, has been nominated for the honour, and no one has been found willing to oppose him. Mr. Will is a native of the parish of New Deer, Aberdeenshire, and served his apprenticeship as a pupil teacher in New Pitsligo Public School. After two years of training at the Church of Scotland Training College, Edinburgh, he was appointed as an assistant in Newcastleton Public School. On leaving this position he proceeded to Aberdeen University, where, after having distinguished himself in several of his classes, he graduated M.A. in 1883. After graduation he was appointed headmaster of New Pitsligo Public School. Early connected with the E.I.S., Mr. Will has been President of the local branch, and has for eleven years filled the post of Secretary with conspicuous success. He has been for several years a member of the General Committee of Management, and has served on the Special and other Sub-Committees. His interest in public affairs is keen and active, and he was recently made a J.P. Mr. Will, I am confident, will fill the position of Vice-President with great acceptance to the members of the Institute. His energy is great, and his knowledge of Institute work is both wide and comprehensive. He does not frequently intervene in debate, but when he does he invariably commands the respect and confidence of his fellow members of Committee.

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Doings of the Institute.

DURING the last month very little of interest has been going on in official circles. It is proposed, however, when the Scottish Estimates come on that a deputation from the Institute shall be sent to the House of Commons, so that if possible questions may be asked with regard to the important subjects of Tenure and Superannuation. It is expected that the Scottish Committee on Education will be interviewed by the deputation, and efforts made to get them to take up the subject of education more earnestly. There is now no hope of an Education Bill, and all our efforts will therefore be concentrated on securing something being done with reference to Superannuation and Tenure.

R. D.

EDUCATION IN FOREIGN LANDS.

Berlin.—The Berlin Teachers' Association has recently sent in to the educational authorities a memorial dealing with the question of the inspection of schools. In this they point out that in Berlin there is not a single inspector who has exercised the functions of the teacher of a *Volkschule*. In most cases these officials have gained their experience in teaching in higher schools. According to the teachers' petition, all the considerations derived both from the nature of the subject and from the lessons of practical experience prove in convincing fashion that the best and most effective supervision of elementary schools is that which is conducted by teachers from those schools who have shown their special fitness for the work of direction and inspection. This principle has long been recognised both by the Prussian Ministry of Education and by the authorities of the large towns of Germany, and it must excite wonder that in a question of this sort the capital of the Empire takes up so exceptional a position. Referring to the teachers' petition the *Deutsche Schule* acutely remarks that the share of control and oversight which is allotted to the teaching body of the public elementary schools forms a good criterion of the share of public recognition accorded to that body. A teaching body supervised and directed by those to whom the schools are practically foreign, is a subordinate body, which may be looked on as sufficiently cultured for lower functions, but which does not appear capable of discharging higher and more important tasks.

Bulgaria.—Recent statistics of school attendance in Bulgaria show a steady and remarkable growth in the number of children of school age attending school. Last year 61 per cent. of these children were in attendance, whereas in 1889 the percentage was only 32. In the year 1891 the girls formed only 21 per cent. of the children on the roll. Now they form nearly 34 per cent. of those under instruction.

Alsace Lorraine.—The teachers in the Reichsland are still subject to the provisions of a law requiring the local educational authorities to report to the district inspector not only on the character of their work within the school walls, but on the way in which they occupy themselves outside their hours of duty. This law dates back to the period when General von Manteuffel was Statthalter, and when some such extraordinary regulation might have been defended by the necessities of the case. The regulation has practically fallen into desuetude, but the teachers object to its presence on the statute-book, as, until repealed, the possibility of its being used in a vexatious and tyrannical manner always exists. The teachers ask that their work within the school shall be judged by educational experts, and that outside the school they shall have the same rights and privileges as other citizens. It is hoped that the Provincial Commission will in its present session afford satisfaction to the teachers' just claims in these respects.

Holland.—The *Nederlandsch Onderwijzers-Genootschap* is at the present time passing through a crisis. It is the oldest and largest teachers' association in Holland. It embraces both head and assistant teachers, has had an existence of sixty years, and has done much useful educational work. As in England, there exist side by side with it the *Bond van Nederlandsche Onderwijzers*, corresponding with our Class Teachers' Federation, and an association of head teachers. The *Bond* is a vigorous association, very combative in spirit, and ready at all times to defend the interests of its members when friction arises between head and assistant teachers. One of the complaints made by the *Bond* against the *Genootschap* was that it had pursued dilatory tactics with regard to a proposed revision of the educational laws giving assistant teachers a voice in the conduct of the school. The *Genootschap* has affirmed this principle, and suggested a revision placing the conduct of the school in the hands of a conference composed of the head and the assistant teachers. Points debated are to be decided by a majority of votes, and the head teacher is to carry out the wishes of the majority. Should he be dissatisfied with any decision so arrived at, he has a right of appeal to higher quarters. The defence of the *Genootschap* to the charge of delay is that its whole energies were taken up by the opposition to the Education Bill which has just passed, and that it was not wise to try and attempt too many things at a time. It was further charged that in two cases at least of dismissal the *Genootschap* had not done its duty; but the answer to this was that there were circumstances in these cases which rendered it difficult to defend the action of the dismissed teachers, and that it was therefore unwise to take further action. The two teachers referred to were even characterised by some members of the *Bond* itself in the *Bode*, its official organ, as a disgrace to the body of Dutch teachers. The crisis between the two bodies culminated in resolutions passed at a general assembly of the *Bond* lately held at Zwolle. The resolutions affirm that class teachers are acting contrary to their own interests in remaining members of the "absolutely superfluous" *Genootschap*, and call on them to weaken its membership by withdrawing from it in a body and joining the *Bond*. The *Genootschap* rightly points out the evils resulting from divided counsels, and trusts that the *Bond* will go back to the policy of its early years when it advised all its members to join the *Genootschap* for the purpose of permeating it with its principles.

Austria.—A voice is raised in the *Œsterreichische Schulzeitung* against the practical tyranny of the obligatory Teachers' Conferences. As many of our readers know, these conferences deal only with questions of school method. A specimen lesson is given by a teacher designated thereto, and questions of practical method arising out of it are discussed. The correspondent whose communication we summarise refers bitterly to the difficulty of getting a hearing for newer methods in an assembly mainly composed of those wedded by long practice to old methods, and who imagine that the foundations of their craft are being endangered when a young and enthusiastic colleague pleads for new ways. There is probably a great amount of truth in this. Some of the newer methods of teaching would, we fear, come badly off if left to the judgment of an English teachers' meeting.

France.—The law of 1844, dealing with syndicates (Trades Unions), gives to those who follow the same calling the right of organising themselves and of striking against conditions of salary, etc., which they find themselves unable to alter. To persons employed by the State similar rights were not conceded; but, nevertheless, 3200 teachers formed themselves into syndicates. The legal officers of the Republic have

entered actions against the officials of these syndicates, and the question has aroused much attention in the press. The Minister of Education has advised the teachers concerned to form themselves into branches of some educational society, such as the *Ligue de l'enseignement primaire*.

There appears to be no dearth in France of candidates for the teaching profession. The number of men candidates has risen from 2383 in 1901 to 4684 last year. Of these only 1578 were accepted. The corresponding figures for the women are: 4534 candidates, with 1444 accepted in 1901; 6993 candidates, with 1705 accepted in 1905.

Switzerland.—*L'Educateur* of Lausanne refers in a recent issue to what is called *paramnesia* in children. This is the learned name for an experience which probably all of us have undergone at some time or other. It consists in the vivid impression that at a given moment we are repeating an action we have done at a former period of our lives, or experiencing a state of mind we have formerly experienced. Illusions of this nature are much more frequent with children than with adults; and M. Auguste Lemaître, who has made a study of them, comes to the conclusion that *paramnesia* consists in a conscious revivification of sub-conscious perceptions. It is produced, he thinks, at a time when the wandering consciousness returning to itself links itself again with the inner psychism from which it had momentarily been separated—as when we think of two things at once, or fix our eyes on something without consciously seeing it. All the children whom he examined belonged to the nervous, emotional, and imaginative type.

THE TRAINING OF TEACHERS.

THE Conference on the education of pupil teachers, held under the auspices of the Association of Head Mistresses, brought together a large and representative gathering of teachers in Secondary Schools. Among other well-known educational administrators on the platform, Dr. Heath, Dr. Osmund Airy, Mr. P. A. Barnett, Mr. Buckmaster, accepted the invitation, as did also Dr. Garnett, Mrs. Bryant, and Miss Fawcett, while the President of the Association was supported by the presence of nearly every member of the Executive Committee.

The first resolution, claiming that the interview of the Head of the Secondary School with the prospective pupil should be a dominant factor in the process of selection, brought out the *further* claim that the selection of scholarship holders should be wholly in the hands of the Secondary School. Many hard things were said of the scholarship holders at present in the schools, the most surprising of which was that not more than one per cent. would at any time be fitted to take up University work or to enter a first grade Secondary School.

> The teachers of the Elementary Schools believe that the proper basis of selection should be a knowledge of the child's past, and contend that those who have known the child for a few years are best able to gauge whether the pupil would reap advantage from a scholarship.

The motion "that the candidates should be examined by the medical adviser of the Secondary School, and refused if lacking in essentials," was opposed by Mrs. Bryant, who considered that the Local Authority's medical officer was the proper person to report to the Local Authority awarding the scholarship. Miss Hanbridge gave some interesting statistics of periodical examinations of her pupils. She compared the results obtained as affecting fee-paying scholars and scholarship holders, showing the physical superiority of the paying scholars.

The resolution asking for "continuity," viz., "that girls preparing to be pupil teachers should attend the Secondary Schools for at least five years," raised the very serious question as to whether the initial age, eleven or twelve years, was not too early an age to select "girls preparing to be pupil teachers."

A special resolution, not printed on the agenda, declared "that in the best interests of Elementary Schools the teachers should for some time be mainly drawn from those whose education had been wholly received in Secondary Schools." This was supported by the statement made by the mover, "that between the ideals of the teacher in the Elementary School and the ideals of the Secondary School teacher there was a great gulf fixed—a gulf that could only be bridged by sending into the Elementary School persons who had been taught and trained in the Secondary School spirit and with the Secondary teacher's ideal."

Miss Phillips roused the meeting and met with considerable sympathy by a spirited protest against the sentiments thus expressed. "A large number of the teachers in Elementary Schools," she declared, "from one end of the country to the other, were doing noble work, and doing it with ideals and aims as lofty as those held by the best Secondary teachers."

Mrs. Bryant made the rather surprising statement that the failure of Secondary teachers to take up work in the Elementary Schools is not due to any idea that the work is beneath them, but is due to the fact that there are not sufficient Secondary teachers to fill the vacancies in Secondary Schools.

In the motion, "That it will be to the best interests of the pupil teachers that they shall not form a separate class, but be in such a proportion to the ordinary scholars that the influence of the Secondary School shall predominate," the speakers found a real difficulty which no organisation seems yet to have solved.

One lady from the provinces asked if any one in the meeting had successfully overcome this half-time difficulty as affecting organisation. At the invitation of the President a reply was given by a Head Mistress, who said, "I think I am the only one in the meeting who can answer that question from personal experience; and I must say that with us the system works admirably—*but, of course, we have the pupil teachers in a separate building.*" The meeting laughed heartily.

Another practical difficulty arose in the second part of the resolution declaring "that it is in the interest of the pupil teachers that their course in the Secondary School should, so far as possible, be continuous from twelve to seventeen years of age; provision being, however, made for some practice in the Elementary School at a sufficiently early age." When was this practice to be secured—before the secondary education was given, or after? What was the sufficiently early age? The nearest approach to a solution of the question was the proposal that the scholarship holders should be sent

into the Elementary Schools for practice during the weeks when the Secondary School was enjoying its longer holiday, there being a difference of about five weeks in the year between the holidays of the two systems.

Mr. Raymond, of the Goldsmiths' College, was of opinion that this "practice" was of little value, and that there was no "art or knack" in teaching which necessitated an early practical experience. He agreed that managing huge classes of 40–60 did require "art or knack"—but such managing of masses was not teaching.

Representatives of other training colleges were of a contrary opinion, and held that the "practice" obtained before entering college proved a valuable ground upon which to found the lectures in pedagogy. The students who had been in school as pupil teachers grasped the inwardness of the pedagogic lectures better than those who had not had that experience.

The remaining resolutions were agreed to with unanimity, being—

(1) That it is advisable to divide scholars into three classes, and arrange their curriculum accordingly:—(i.) Those who will ultimately take a degree; (ii.) Those who will take a Matriculation Examination or its equivalent; (iii.) Those who will take the "Preliminary Examination for Certificate" (*i.e.* the King's Scholarship Examination).

(2) That a sound English education is of much greater importance than a knowledge of many subjects.

Miss Connolly, in eloquently singing the praises of our language and literature, shocked a part of the audience with the astounding phrase "these young people coming from their homes of ignorance, squalor, and vice," and roused all to a joyful enthusiasm by the declaration that "at last the first step has been taken, and these young people have been sent to us."

Miss Bishop, Principal of St. Gabriel's Training College, was of opinion that the first class, *i.e.* those taking a University course, would be practically non-existent if Circular 530 remained in force. Whatever the intention of the Board of Education might be, the effect would be to deter principals from advising or allowing students to take up University work.

This brought Mr. Heath forward with an unconvincing protest that the intention of the Board was not to set an impossible standard.

Professor Adams, in moving a vote of thanks, raised loud applause with the statement, "the pupil teacher system is dead," and added that the best thing he had heard during the afternoon was the statement made several times, "I have consulted one of the Head Teachers of the Elementary Schools in my district." He urged every one in the room to place herself in the position of being able to make the same statement, and to those who had made the statement he would say, "Now consult several more."

Shorthand.—Many of our readers have acquired a certain proficiency in shorthand, mostly on Pitman's system. We have recently received a booklet explaining how the higher parts of this system have been improved by Mr. Dawdry so that the art of verbatim reporting may be easily acquired.

The Women's Tribune.—The first number of this new paper appeared on May 18th. It promises to deal with many topics of interest to lady teachers.

BOOKS FOR THE LIBRARY AND THE POCKET.

CHARLES LEVER.

THAT Charles Lever, who died so recently as 1872, should seem to have already become "portion and parcel of the dreadful Past" is significant of the hurrying and forgetful age in which we live. Among the recent innumerable "Lives" of great writers, novelists, actors, hermits, bad and good men, which glut our biographical indexes, one fails to find the slimmest *brochure* devoted to the brilliant Irishman. And this in spite of Lever's novels having still a vogue—and yet, we hope, to have a greater; that they have many intrinsic excellences; are full of wit and humour; give the most vivid pictures of life and manners, of fair women and gallant men; have such stirring tales of adventure by camp, and flood, and field; above all, too, are permeated by absolute sanity of mind; full of pure, fresh, healthy, tonic qualities. That the readers of our time should seem to neglect the best works of Lever, and cling to the novel of the hill-top or the sewers, to Paul Pry-like studies of the "eternal feminine," worship the idols of the Ibsenite, recalls the allegory of the children who sought the rainbow-gold, left the pleasant, sun-illumined fields, and at eve found but the bleak and desolate moorlands!

But it is the duty of every lover of good literature who sees his fellow-pilgrims wander in dubious ways in the desert to guide them to the oases. And such is our humble aim in writing these few sentences on the author of *Harry Lorrequer*.

. . . . . .

Lever's "Life" has already been written—by Dr. W. J. Fitzpatrick—in 1879. It is not satisfactory. Granted that his material was abundant, it does not justify the scrappy and jumbled way in which he grouped it. The novelist's daughter referred to it mildly as "inefficient." It is hard reading—'tis pity that one should need to say so, but this perhaps accounts for the dearth of lesser monographs already referred to.

Fitzpatrick quotes with approval from a review of his book by the *Examiner*, that he "had not been content to imitate the usual and certainly inartistic plan of spinning a biography out of a *catena* of letters, with brief intermediate links of narrative." How, with all the examples of great biographies, from Johnson downwards, he could applaud this advice is peculiar. And it is precisely this *catena* of letters that was wanted, and which Mr. Edmund Downey now gives us in the two handsome volumes just issued by Messrs. Blackwood.[1]

Needless to say, Mr. Downey's book admirably supplements Fitzpatrick—nay, displaces him—and will, we fear, end by driving him to the top shelves of the bookcase.

Charles Lever was born in Dublin in 1806—just a century ago. He came of English Protestant descent, his father being a prosperous builder. The boy had a good education, and soon exemplified the best racial characteristics of Erin—its buoyant, happy spirit, its lighthearted, generous fervour, its free-and-easy ways, its exuberance of speech, jest, and exaggeration of fact. Assimilation was a trait of Lever. In Germany he "took on" all that the *Zeit-Geist* could give him of

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[1] (*a*) *Charles Lever. His Life in his Letters.* Blackwood. 2 vols. 21s. net.

(*b*) *Harry Lorrequer. Charles O'Malley. Jack Hinton. Tom Burke of "Ours."* Nelson. New Century Library.

student life and *Burschenschaft*, while in later years his residence in Brussels gave him the *esprit* and *gaieté de cœur* of France, with its other side, however, of quick despairs and sudden melancholies.

Lever as a boy was fond of reading—of Scott especially; he was keen on theatricals; loved a practical—if harmless—joke; indeed, all sorts of good-humoured play. He took medicine for a career; went to Germany, to "walk the hospitals"—and elsewhere; studied at Göttingen, Heidelberg. He was in Vienna, Weimar (where he saw and heard Goethe), returning to Ireland to practise.

This proved a poor business, and, with all his rollicking humour, he found daily life a struggle. He married, however; started with his pen on *Harry Lorrequer;* but abandoned his dispensary work in Ireland in 1837 for Brussels, where, with the patronage of the British Minister and the assistance of the English colony, he hoped to mend his fortunes. He was quickly disappointed with his change, and, although several times on the point of decamping, stuck there for several years. Here he finished *Harry Lorrequer*, wrote *Charles O'Malley*, and began *Jack Hinton*. Receiving the appointment of editor of the *Dublin University Magazine*, he came back to the Irish capital, but the hurrying unrest which had settled on him made him give this up in 1845. He went to the Continent, wandered about, writing strenuously his long list of novels, few of which, however, came up to the old standard. He became Vice-Consul at Spezzia, and finally Consul at Trieste, dying there in 1872. Such is the briefest epitome of Lever's "fitful fever" of life.

Mr. Downey gives many bright and cheery extracts from the genial writer's letters, the main part being to his esteemed friend and publisher, Mr. John Blackwood. Many of them refer to "that eternal lack of pence which vexes public"—and private—"men." Their very hurry and rapidity recall the man, cheery, gay, dispirited, despairing, on the same page, but always bubbling over with some good story, or incident, or saying; the letters are kind, generous, Celtic to the core. He had all the literary man's passion for spending, and for getting little in return. Like Moore, he mixed in good society and depleted his purse in entertaining. Some of his letters are pathetic in regard to monetary affairs, and yet he made a good income.

But to *know* Lever we must come to his books.

> "History is half-dream—ay, even
> The man's life in the letters of the man.
> There lies the letter, but it is not he
> As he retires into himself and is . . ."

You have to read *Harry Lorrequer* to feel the buoyant spirit of Lever. Here is the painter of life and living, the *raconteur* of a good story. There is a brilliancy about Lever's writing that beats even Scott, if it lacks the mystic romanticism underlying all that the "Wizard" wrote, which makes you hear at times

> "The horns of Elfland faintly blowing."

That little exquisite picture of the scene at the Cliffs of Moher is pure Ruskin. And then what fine hearty character-drawing in Mrs. Healy, Miss Betty O'Dowd, Father Malachi!

And what a fresh and clear-hearted book is *Charles O'Malley!* Micky Free is an Irish diamond of the purest water; as for Webber and Monsoon, one wonders why they are unknown quantities in ordinary conversation.

Consider, too, the war pictures—the night after Talavera, Quatre Bras, Waterloo, in that novel, and all the glorious pomp and panoply of the campaigns of the "Man of Destiny," in *Tom Burke;* the Napoleon episodes—Austerlitz, Berlin after Jena! How they stir the blood as we read!

In *Jack Hinton*, after the narrative of the doings of an English guardsman in Ireland, comes a change of *venue* to Burgos, Vittoria, Paris in 1814; exactly what Lever can do better than any one else, and give you as you read that

> "crowded hour of glorious life
> That's worth an age without a name."

These four books are Lever's best, to our mind, and on a recent visit to the Low Countries, viewing some of the notable historic spots to which Lever used often to go with a party as *cicerone*, we took care to provide ourselves with the handy pocket editions of them which Messrs. Nelson issue in their New Century Library. It was almost like having "Harry Rollicker," as Thackeray called him, beside us!

One word more. Summer is coming in, and it is perhaps the only time when some of us get a chance of reading anything, owing to the multiplicity of winter engagements. To such who have not read Lever, we commend, in this his centenary year, these four novels; and when done with, and they wish to know what manner of man the writer was, let them take up Mr. Downey's pleasant and readable work. Both together will give them a complete portrait of Charles Lever.

MY GARDEN.

IT is a peaceful, calm retreat,
Away from the city's din;
A world of strife shut safely out,
A home of rest shut in.

My roses bloom perfumed with love,
Sweet thoughts my pansies fill,
And rows of blue forget-me-nots
Fond memories distil.

My gillyflowers have homely worth,
Thrift borders grow apace,
While sturdy foxgloves stand behind
As guardians of the place.

The tassel-flowered laburnums droop,
Heavy with showers of gold,
And pinks breathe aromatic air,
Like Eden's flowers of old.

Blue bells and white ring out their chimes
With every graceful nod,
And lilac spires on leafy fanes
Point upwards to our God.

Around the door and window-frames
The fragrant jasmine grows,
With myriad milky stars lit up,
To brighten Summer's close.

Even when the wealth of flowers is spent,
And Summer's glory fled,
My garden is a home of hope,
Peopled with living dead.

Amid the Winter's storms and gloom
I have no doubts nor fear,
For with Spring's recreating breath
The flowers will reappear.

S. M. Rodgers.

OUR CLASSROOM AIDS.

THE "SUGGESTIONS" FOR TEACHING HISTORY.

III.—SCHEMES OF WORK.

BY HENRY SMALT, M.A.

WE premise our remarks on this part of the subject by laying down two axioms:—

1. No suggested scheme is likely to please everybody.

2. It is highly desirable that all schools in the same district should follow the same course. But though this is an axiom, yet it represents a consummation to be hoped for rather than expected. And even if it were accomplished, doubtless many who hoped for it would, though they accepted it, be among the first and warmest critics of the suggested scheme, thereby illustrating the truth of our first axiom.

A consideration of what we have already said on the teaching of history, together with an examination of the courses of work suggested in the Blue Book, brings out the desirable points at which to aim. These by their number demonstrate the difficulty of arriving at a satisfactory scheme. Hence any adopted scheme must be a matter of compromise.

1. It is chiefly the human interest in history which appeals to children. This is therefore to be cultivated; and yet, if we may venture to say so at the risk of calling down imprecations upon our devoted heads, history must not be allowed to degenerate into mere biography.

2. By the time they leave school all children should have a reasonably clear and connected idea of the story of their own land.

3. It is highly desirable that the history of other nations besides our own should be taught.

4. The study of a special period is very useful. A reasonably short period can be studied in considerable detail, and, in addition to the interest which always attaches to a detailed picture, it gives the children an idea of what the study of history is.

5. The study of documents and of original authorities is also very useful, and if possible a little should be done in this direction. It is quite distinct from 4 (above), and gives pupils an idea of what the task of the historian is.

The work suggested for the first four years of school life is all that can be desired. During these years the work is very properly limited to the study of biographies; but whereas during the first two years the subjects may be selected from a very wide range and materials drawn from very varied sources, during the third and fourth years they should be drawn from English history.

During the first and second years we are dealing with children of seven to nine years of age, and subject and treatment must therefore be striking and simple. "Stress should be laid on the personal qualities of the heroes of the stories. . . . The whole effect of teaching of this kind depends on making the impression as vivid as possible" (p. 119). But during the third and fourth years we are beginning English history, and the boys are older, and therefore better able to appreciate the qualities of their heroes. Here we are laying a foundation for the study of English history by giving some knowledge and awakening interest. If the work of these two years is well done, the work in the succeeding standards will be lighter and more effective.

During these two years the children should begin to have an idea of chronology. A few dates should be taught, marking the years of the great achievements of the persons studied. This is not asking too much, nor is it going beyond the abilities of boys in the Fourth Standard. We give them a few figures in geography, and may well give them a few dates in their history. The biographies should be taken in chronological order.

But the important work of school life, so far as history is concerned, is to be done during the last three years. For these years three different courses of work are suggested, each of which we now consider.

Scheme A.

This is practically an example of the so-called "concentric" method. We will start by saying that we consider it a very good scheme.

During each year the whole of British history is to be studied, and in each year the method is by a combination of oral lessons and the study of a text-book. During the second year special attention is to be given to the expansion of the British Empire, and during the third year to the study of constitutional history, while during this year lessons are also to be given on citizen-

ship. During each year suitable poems are to be learnt, and historical tales or novels read. According to this plan we first take the great landmarks, and then gradually fill in the spaces between. These "large and imposing figures and striking events" will serve as beacons to keep the children from straying, or as cords to hold together their knowledge of history.

A special and excellent feature of this scheme is the suggestion that a special period should be studied during the last year, which should refer to the district in which the school is situated. This is an extension of the prevalent and correct idea that English boys should study chiefly English history. The districts mentioned are said to be given as examples, but really they divide England and Wales, roughly, but with quite sufficient definiteness, into six districts—North of England, East Anglia, Midlands, Wales, West of England, London. In such a case as this the boundary of the district is not to be marked very rigidly. The Committee of Seven, to whose Report we have already referred, give an example of the extreme length to which this practice can be carried in the custom, which they found prevalent in the United States, of studying the history of individual states. They call it "an evidence of misdirected patriotism, and also probably a result of the pedagogical cry that swept the country a few years ago, 'from the known to the unknown.' . . . The demand for state history rests on no substantial basis, either historical or pedagogical." This is a warning to be taken to heart while studying local history, but if such excesses are avoided the plan must be productive of good, for naturally a West of England boy, for example, will like to learn of the Elizabethan adventurers.

This last year's work will be a full one. There are three branches of work for which to find places—general English history, a special period, and citizenship. The best plan will, we think, be as follows: Divide the year's work into three terms. During the first two terms cover English history, the break coming at 1603. Then during the last term devote one lesson a week to the special period and one to citizenship.

The great weakness of this scheme is that no provision is made for the study of European history. This is much to be regretted.

Scheme B.

The time-honoured description of the method here adopted is the "Periodic." As we were frank in giving our description of **Scheme A**, so we will be equally frank here, even though we offend many. We do not like it.

According to this scheme, during the first year we teach British history up to 1485, giving special attention to the two great features of this period, the making of England and the rise of Parliament. In the second year we take British history from 1485 to 1688, with its important features, the Reformation, the expansion of the Empire, and the struggle between King and Parliament. In the third year we study the rest of British history, with the expansion of the Empire, the Industrial Revolution and its natural sequence, Reform Bills, and we give lessons on Citizenship.

No one will deny that this method has its advantages. Later history is studied by the children during the year of their greatest ability. This period is the most important to study, and yet, in some respects, the most difficult. The period cannot be understood without studying political changes, but these are not interesting to young children. It is difficult enough to teach them to boys in Standard VII.; with boys in Standard V. it is practically out of the question. Many teachers and writers therefore prefer to take the extreme course of ignoring later history altogether till boys are in the last year of their school life.

When this method is adopted, the whole of the last year, which is the best, is devoted to very modern history, which is the most important. This is a manifest advantage.

Again, it is very evident that a period is more manageable than the whole. Unless very careful elimination is exercised, to cover the whole of English history in one year means more or less of a rush.

But we think the drawbacks to this method outweigh the advantages. Some, in fact many, boys do not arrive at Standard VII. Hence, if this scheme is adopted, many of them will not cover the whole of English history. Moreover, if they do not, the part not covered will be the most important—modern history. This is what Seeley complained is often the case with adult students. Years are spent in their case in learning ancient and mediæval history in order that modern history may be learnt and appreciated; but modern history is never learnt, and the study begins and ends in preparing for a task which is never accomplished. "The student commonly breaks off his historical course in the middle. He learns, more or less perfectly, those periods of remote history, whether ancient or modern, which are so rich in illustrations of our own time; but when the comparison between the present and the past comes to be made, when the analogies are to be traced, and the results of the whole complicated process to be obtained, the student is tired, or has not energy to enter upon the new task, or the business of life has come upon him and left him no more leisure." It is this which has led some even to suggest that we should teach history "backwards."

According to this scheme, English history to 1485 is to be studied during the first year, and no opportunity is given for revision. Consequently all that is to be learnt of that period must be learnt then. During this period constitutional matters are very important; but they are difficult to understand at that age. Many great constitutional documents must be referred to, but they will certainly not be interesting to boys in Standard V., and can hardly be appreciated by them. The struggles, *e.g.* between John and his subjects, and between Edward I. and his barons are difficult for, if not altogether beyond the ability of, boys at this stage. But all these matters are most fruitful objects of study in later years.

Lastly, during the second and third years appeals will constantly be made to knowledge of earlier history. But these appeals will be made to knowledge of a period studied when the children were younger. Boys in Standard VII. are of far greater ability than boys in Standard V., and, owing to this advance in ability, the "comparisons between present and past" cannot be profitably made, nor can the analogies be profitably traced. It will be impossible to go back during the last year and teach what we were unable to teach during the first year, as the fresh ground to be opened will prevent it.

These terms "concentric" and "periodic," though widely used, and though very useful in describing the

methods of dealing with the subject, do not exhaust methods, nor does their wide use debar the teacher from combining them. If he wishes to do so he can during the first year cover English history to 1603, and during the second year finish the story. Then during the third year he can revise the whole, filling in details, and dealing with subjects which, on account of the lack of ability on the part of the children, he thought better to leave during the first year. This method would form a good compromise between the two, combining some of the advantages of both.

Scheme C.

So far European history has not been studied, which is a grave omission. But when we pass to Scheme C a great improvement is evident. This scheme is described as being "more ambitious in its scope and more specialised in character" than either of the others, two descriptions which well fit it. It is recognised that such a scheme can be worked only within limits, in "well-staffed schools," and with "pupils of more than average attainments who have already received a fairly broad foundation before reaching the fifth year."

The first year is to be given up to European history. This, judging by the examples given, is chiefly to be studied in biographies and battles. Heroes and events are to be chosen from ancient, mediæval, and modern history. During the second year the work goes on in three directions: (1) Growth of the British Empire, studied again chiefly in biographies; (2) citizenship; (3) local history. The third year is divided equally between the study of a special period "of about thirty years," which could therefore be studied in considerable detail, and lessons on citizenship.

This scheme presents obvious advantages, and well illustrates the necessity for compromise which we pointed out earlier. Large use is made of the interest which always attends the study of biographies. By the time boys leave school they will have a certain familiarity with the leading events and people of European history, their interest in historical study will be aroused, and they will, by their study of a short period, have an idea of what the subject is like. Since lessons on citizenship are given during the last two years, a good knowledge of this important subject should be acquired.

But to secure these manifest advantages something has to be sacrificed. This scheme gives no opportunity for a connected study of English history. It is true that the Blue Book says that when this scheme is adopted a "fairly broad foundation" must have been already laid. But this foundation must have been laid during the first four years of school life, and we think that even with pupils of "more than average attainments" it will not be very broad. True, Freeman says that "without clear notions of general history, the history of particular countries can never be rightly understood," but we think that before plunging into European history a boy should have a better knowledge of English history than will be acquired in Standards I. to IV. Moreover, the first year being devoted to European history, the other two years give no opportunity for acquiring that respectable knowledge of English history which is so desirable, for the second year is devoted to the growth of the Empire and the third to a special period.

For two reasons we do not think it advisable to devote the whole of the last year to a special period, though such a study is a most excellent thing. Our first reason is this. The last year of school life gives the best opportunities, on account of the ability of the boys, of taking broad generalisations and comparisons, and of studying great connected movements. These studies are highly educational, but the study of a short period does not give great facilities for them. The second reason is special to Scheme C. If the scheme is followed, boys will have little idea of the position occupied by the period studied. "No one can really study any particular period of history unless he knows a great deal about what preceded and what came after it. He cannot seriously study a generation of men as if it could be isolated and examined like a piece of inorganic matter. He has to bear in mind that it is a portion of a living whole which is under his observation."[1] This is as true with children as with adults, for whom it was written. Under Scheme C boys will be studying a special period without due preparation, and it seems to us that the teacher must either spend many of his thirty-five lessons in giving this preparation, or else give lessons on a period whose significance will not be appreciated.

Again, while fully recognising the value of the study of biographies, and while glad to see the teaching of European history introduced, we think that in this scheme the biographical treatment is carried too far, and that European history could and should be taught in a more systematic way than is here recommended for the first of the last three years of school life.

Our last objection is that constitutional history is practically omitted.

We may appear to be speaking rather strongly, and therefore explain that we make these remarks with some diffidence, as we are told that the scheme has been found "eminently suitable" for certain schools.

Having said so much, it may seem to some to be rather impertinent on our part to suggest another scheme, and we may appear to devote a rather undue amount of space to a scheme of our own devising. We explain, therefore, that in suggesting a scheme we fully recognise the truth of the first axiom we laid down above, and that many of the remarks we shall make with regard to work in the first and third years apply to Scheme A, but are more fitly introduced here.

A Suggested Scheme.

First Year.—During this year, as in Scheme A, take outlines of English history. A somewhat strict process of elimination should be carried out, and matters which on account of time cannot be treated with sufficient detail, or which on account of the small ability of the pupils cannot be appreciated, should be omitted altogether. Social history, under which term we may include the food, manners, clothes, and dwellings of our ancestors, may well receive considerable attention. It treats of matter which all children can understand, and which is very interesting. Exact dates are out of the question and names are not wanted.

It is rightly recognised in the Suggestions that the reading of historical fiction is very useful, and it is chiefly in the teaching of social history that its use lies. Two important advantages attend this study,

[1] Gardiner.

especially when carried out or amplified by the reading of historical novels; it makes the past live, and it exercises the imagination. Macaulay, in a well-known passage, has pointed out what has come to be regarded as almost the province of the historical novelist. "To make the past present, to bring the distant near, to place us in the society of a great man or on the eminence which overlooks the field of a mighty battle, to invest with the reality of human flesh and blood beings whom we are too much inclined to consider as personified qualities in an allegory, to call up our ancestors before us with all their peculiarities of language, manners, and garb, to show us over their houses, to seat us at their tables, to rummage their old-fashioned wardrobes, to explain the uses of their ponderous furniture—these parts of the duty which properly belongs to the historian have been appropriated by the historical novelist. . . . Sir Walter Scott gives us a novel; Mr. Hallam a critical and argumentative history. Both are occupied with the same matter. But the former looks at it with the eye of a sculptor. His intention is to give an express and lively image of its external form. The latter is an anatomist. His task is to dissect the subject to its inmost recesses, and to lay bare before us all the springs of motion and all the causes of decay." Of course historical novels contain mistakes. These are of two kinds—those necessary for the plot, and those which are quite unnecessary; and it is the latter class which is to be particularly deplored. But although we regret these mistakes, and although a student may air his knowledge and bore his friends by pointing them out, yet such works do not profess to be histories, and should not be regarded as such—

> "Mine is a tale of Flodden Field
> And not a history."

Other matters which should receive considerable attention during this year are discoveries and explorations, inventions, and warfare.

Constitutional matters should be largely ignored during this year. This is quite possible in dealing with the earlier periods. Thus the feudal system can be taught as a matter of land tenure and military organisation. In later times, as under Charles I., parliamentary affairs must be mentioned, but by the time that is necessary Parliament has developed into a body somewhat like it is at the present day, with which boys are more or less familiar. The question of its growth and the growth of its powers may well be largely left to a later stage. If any branch of constitutional history is studied, it should be the question of kingship, with the two ideas of election and heredity at work.

Cause and effect should receive some attention, but not much, and when attempted it should be in a very elementary way. Comparisons, on the other hand, should be largely used.

Most teachers would probably prefer, during this year, to treat the earlier periods with reasonable fulness and modern history quite briefly, dealing simply with such matters as inventions, colonisation, and wars.

The object of this year's work should be to give a fairly connected outline of the story of English history, to familiarise the children with the names of the great actors, and to give some idea of chronology. The great landmarks should be thoroughly fixed in their memories. We should frequently go over them, treating them in various ways. The names and dates of the sovereigns should be learnt. We should give various exercises, all tending towards the laying of a firm foundation.

Second Year.—We should like to see this year given up to European history. As the subject is very wide, it is better to ignore ancient history, except so far as it is necessary to give some account of the Roman Empire, and the subject should be treated topically. The topics treated should be taken as far as possible in chronological order, and connections between them in time and in cause should be pointed out. Maps should be freely used, and comparisons with the map of Europe of to-day frequently made. It is well if the maps are rough sketch maps, ignoring all minor and unimportant details. English history should be referred to where it touches European, *e.g.* The Northmen, The War of the Spanish Succession, The French Revolution. The connection of the various countries with our own should be shown, and the position of England in European politics should be pointed out.

As an illustration of the way in which the subject may be treated, we suggest the following list of subjects:—

Charles the Great and the Holy Roman Empire.
The Papacy. Reformation; Monks and Friars.
The Turks.
The Northmen.
The Feudal System.
The Crusades.
Spain. The Moors. Ferdinand and Isabella.
France, to Louis XI.
The Renascence.
Exploration.
The Protestant Revolution.
Charles V.
The Thirty Years' War.
Louis XIV.
Russia, to Peter the Great.
Charles XII. of Sweden.
The War of the Spanish Succession.
Frederick the Great of Prussia.
The French Revolution and Napoleon.
Russia and the Crimean War.
Italy.

This list shows that it is possible to arrange a series of about twenty subjects which shall treat European history sufficiently well. The number of lessons to be devoted to each subject would vary from one to four. Such a course of work would be interesting and instructive, and would prepare the way for an intelligent study of English history during the last year.

Third Year.—During this year study English history in as great detail as possible. Topics treated during the two previous years should be passed over lightly, and during this year subjects entirely or practically omitted before should be discussed. Thus attention will be concentrated on such subjects as the growth of Parliament, the struggle for the mastery between Parliament and King, Colonisation, Literature, the Industrial Revolution, Reform, the Constitution at the present day. Constitutional history will be the special feature of this year's work. With this exception the earlier periods will be treated briefly; modern history, on the other hand, will receive much attention. Thus this year's work will be practically the same as that recommended in Scheme A. This is the year dur-

ing which the teacher should occasionally read extracts from good writers, *e.g.* Oman's account of the Battle of Towton in his life of the King-Maker, or John Morley's description of the quarrel between Fox and Burke in his life of Burke.

During the last term of this year some lessons should be given on great movements and broad comparisons and generalisations. We suggest a few subjects suitable for such lessons:—Conquests of England, by Romans, English, Danes, and Normans; England and Rome; England and Scotland before the Union; famous royal marriages and their effects; rebellions, treating of their causes and effects, and classifying them. When such lessons are being given some chronological tables should be at hand, and should be constantly referred to.

While discussing the teaching of history, we emphasised the importance of teaching European history. That is one reason why we venture to suggest this scheme. Having urged that European history should be taught, we felt that we must suggest a time in which to teach it. We do not pretend that this scheme is a perfect one. As in all others, something has to be sacrificed. But if this scheme is followed, boys will acquire a reasonably good knowledge of English history, and some acquaintance with that of other countries.

A VOLCANO IN ERUPTION.

EVER since the days of Titus the Emperor, when Pliny witnessed the destruction of the twin cities that lay so unsuspectingly in the Campania Felix, Vesuvius, that most famous of volcanoes, has given notice of his continued existence by sundry growlings, and vomitings of smoke and flame, interspersed with an occasionally more violent outbreak. He is just simmering down after his recent activity, and, as a teacher whom a fortunate chance allowed a year of travel before commencing work, perhaps my experiences might be of interest to others in the profession who are striving to give as much local colouring to their geography lessons as possible.

VIEW FROM THE BALCONY.

Chancing to be in Naples a few months before the last eruption, I took the opportunity of forming an acquaintance with the mountain by ascending it several times on the electric railway, by means of which, thanks to our premier tourist agents, the summit may be reached with comparative ease.

Chartering a "carozella," with its gaily caparisoned little pony, one can drive from one of the piazzas in the heart of Naples through the suburbs of San Giovanni and Portici, with their lively but squalid street scenes, to Pugliano, right at the foot of the mountain, where the line that makes the ascent commences.

Entering an electric car holding about twenty passengers, we began to rise with but a gentle slope through an amazingly fertile belt of ground, the cultivated zone. Here the luscious grapes, from which the world-famous Lachrimi Christi wine is made, grow most abundantly, while gardens and orchards draping the slopes with all the magnificent array of a Neapolitan summer also attest the productiveness of this light friable lava soil.

Here and there, as the quaint little homesteads of the Italian contadini that formerly dotted the line become scarcer, we pass through shady chestnut woods and over grass-covered ravines, but little different from those through which the Snowdon railroad cuts its way from Dinas to the summit. At the Hermitage Station, half-way up, we find that the enterprising Cook, who built the railway, has also erected here a fine modern hotel, commanding one of the most magnificent prospects in the world.

Beneath us, far out to the distant horizon, stretch the glittering waters of the Mediterranean; to the right Naples, like a long white band, extends along the shores of the bay to Posilipo far away to the north. At our feet nestle the villages of Resina and Torre del Greco, whose inhabitants have since had to fly *en masse* from a deluge of red-hot ashes that fell from the mountain above, and a torrent of incandescent rock that encircled them in a fiery grasp. At this altitude the atmosphere was so remarkably clear that one could scarcely credit the fact that individual houses pointed out to us, and so clearly discernible, as being on the island of Capri, were as far away as Calais would be were we standing on Dover cliffs looking at the French coast.

But what a change was experienced on leaving the Hermitage, and drawing near the Observatory, built high up on Mount Cateroni, to observe any indications of and phenomena connected with an eruption. Vegetation in abundance gave place to a vast field of desolation, which never fails to impress the spectator with awe at the titanic forces which can change the smiling country around into an irrecoverable desert. Lava lies everywhere in this dreary region, of a uniform dark brown colour; in rolling, petrified streams

as it flowed centuries ago; in masses twisted and distorted by the heat, or again in huge solid blocks just as they were flung from the seething crater above.

At the foot of the cone itself we changed cars into the Mono-Rail Funicular, which in ten minutes took us within a few hundred yards of the crater itself. This crater has now entirely disappeared, as though a gigantic hand had pushed the whole top of the mountain downwards and sideways towards the sea, with the same ease that an Italian ice-cream seller shapes the ice cones in his glasses.

On alighting at the summit we found the real difficulties commencing. The way is steep, and being composed solely of loose ashes, dust, and rough stones, it is for all the world like climbing up the pit-bank of a north country colliery. But, sometimes up to the knees in the black lava dust, or again reduced to the level of hands and knees even, we at last struggled to the summit. Should we be ladies, or really feel unequal to the task, a kind foreseeing Government has provided stalwart guides, who will carry the lazy or incapable in a "chaise à porteur," for which luxury, however, one may be sure there is an equally luxurious charge.

In front, and when the wind blows in our direction, all around us, hot smoke and evil-smelling vapours rise from the abyss below, and the sulphurous fumes give us a choking sensation that is not dispelled for hours afterwards. Fissures gape on every hand, and red-hot stones and lava, now and again, rise like a fiery fountain, to fall back again into the crater as a molten shower. The continuous roaring and ominous rumbling make the nervous look apprehensively at the stolid guides, who regard the volcano much as a puddler would do his blast furnace—hot, uncomfortable, dangerous even, but for all that, lucrative.

The ground all around is scarred and torn, and so hot in some places that eggs might easily be cooked on it, and many a pair of good shoes has been utterly ruined during the few minutes' stay the wearer made in this region of fire. Still, what are a pair of burnt boots, torn and dusty clothes, and a general feeling of having been slowly choked with dust and gases, to the fact of having gazed into the crater of an active volcano that has been continually throwing up its broad column of smoke and steam for centuries past, and that has since sent tens of thousands of panic-stricken men and women flying headlong from the reach of its death-dealing agencies.

A few minutes on the edge of the trembling crater was quite enough for most of us, and we returned to Naples indescribably dirty, as though we had taken a shower bath of iron filings—fearfully stiff and tired, but thoroughly happy in having accrued a store of such striking impressions as will last as long as memory retains her seat.

Passing through Torre Annunziata—one of the three villages that nestled so confidingly at the foot of Vesuvius—a few days later, I asked one of the oldest inhabitants why they did not give a wider berth to the destructive monster.

"Ah, signor," was his reply, "we find there are many, many worse things to be avoided than old Vesuvio. He destroys sometimes, maybe; but think what we owe to him. 'Ecco!"

He pointed to his fields, in which no less than three different crops were growing simultaneously. Shady olive trees were festooned with vines heavy with bunches of ripening grapes, while below a crop of yellow corn was waving gently in the breeze.

"All this we owe to Vesuvio, signor. And see! my houses, and all the others too, built of lava on lava—Vesuvio again."

But how soon this indifference of the Torrese and Neapolitans, begot of the seeming good-natured laziness of the volcano above them, gave place to abject terror when rumblings and earthquakes occurred. So

THE MONO RAILWAY.

that a few weeks ago, when doors rattled and windows snapped, and every movable ornament was thrown down by the earth quiverings; when water failed in some wells and suddenly appeared in others long dry; and when the steady column of smoke, always rising from the mountain, assumed a denser, darker hue; the ever-superstitious Torrese hastened to their little churches of San Giovanni and Santa Lucia, and laid before their patron saints additional reminders of their extreme piety and worthiness in the shape of candles and votive offerings galore, entreating them meanwhile to exert their intercessory powers. The Neapolitans too, although the last people in the world to take things seriously, processioned the Via Duomo and the Piazza Fernando day and night, alternately imploring and cursing their particular saints, Januarius and Anna—and to what avail?

The eruption had already commenced when I returned to Annunziata from Sicily, and from the crater of the mountain dark sulphurous smoke was belching forth continuously, impetuously, one puff seeming to propel the preceding one higher and higher into the murky air, so that an enormous bank of smoke and

steam hung over mountain, sea, and village like a gigantic pall. At times, however, this cloud would appear as white and harmless as a mass of downy cotton-wool, and then again, as the sun rays struggled through, it would exhibit the most charming colour effects imaginable—changing from silver to blood red, and anon to mauve or purple, like an Indian sunset, and finally resume its forbidding hue.

What struck one on disembarking at the little port was the fact that every one else was as eager to leave the place as we were to stay and inspect it. Not a solitary driver was at the landing-stage, where formerly hordes of importunate and impudent Pompeians had cajoled or threatened the traveller into hiring their ramshackle "carozzas." The macaroni shops were shut down, and the long sticks in the drying frames, still standing in the sun, were turning from a creamy white to a fine carbon hue.

The one long straggling street presented just such a scene as occurs at a City fire; pathetic almost to tears sometimes, but now and again, perhaps because we had nothing to lose, humorous in the extreme. Here sat huddled on the dust-covered pavement a group of dishevelled women, nearly mad with grief and terror, weeping over the loss of home and possessions. A few yards off was the portly landlord of the Locanda piling an open cab high up with bottles of his precious Chianti and Marsala, while his wife with frantic haste was harnessing a diminutive ass alongside a gaunt Torrese pony. Anon a brown-habited padrone was to be seen carefully shepherding a flock of small children into the military mule-wagons that were waiting to take them away from this little-understood terror to the Naples of their dreams. In the deserted churches a few flickering candles threw ghostly shadows on the images which the worthy fathers had swathed in white before leaving them as they thought for ever.

The heat seemed intolerable, and added to that was a choking gaseous smell and a heavy rain of gritty dust particles that invaded everywhere—clothes, hair, eyes, mouth, nothing escaped; and how one pitied the poor folk of Pompeii, on being buried beneath eighteen feet of such horrible stuff.

Eager to become more closely acquainted with the fiery monster, I tried to ascend the mountain by a familiar mule-track that led from Torre up through Bosco Reale (now covered for all time by a lava bed ten feet thick) and succeeded for perhaps half a mile; but then, before my progress was interrupted by nature, my way was barred by man in the shape of a blue-coated "carabiniere" drafted in from Naples. These boyish-looking soldiers formed a cordon around the mountain, and no persuasion, whether eloquence, or (what more quickly moves the Italian conscript) the promise of a few lire, could shake their adherence to the orders that no one should ascend unless specially authorised.

So one had perforce to be content to watch from afar the showers of hissing red-hot stones and scoriæ that fell incessantly on the higher slopes of the mountain, a fiery hail that would have enveloped Naples in flame had the wind driven it in that direction, and that did actually destroy miles of the Circum-Vesuvian Railway. The force with which these projectiles were whirled heavenwards from the crater, together with their magnitude, would seem incredible to one who has never witnessed an eruption. One massive fire-scarred boulder I saw, that had been flung into a ravine called the Attrio da Cavallo, must have weighed hundreds of pounds, though that was a pigmy to one the guide used to show that had been whirled a quarter of a mile, although the size of a small room.

Perhaps the most gloriously picturesque view of the whole eruption was to be witnessed from the handsome lighthouse at the end of the Naples Molo, that shelters the dandy pleasure-craft of our modern aristocracy. By the kindness of an official I was allowed to ascend to the lantern at night, fortunately at a time when the air was comparatively clear owing to a strong sea breeze, and from there the deep red fire within the crater could be seen glowing in the darkness six miles away, sullenly reflected by the huge smoke clouds banked above it. The ruddy glow, and the columns of fire now and again stabbing the night, together with the black background, made the finest contrast imaginable, and the long lane of crimson light it threw on the tossing waters of the bay added just the necessary touch to make the view sublime.

After gazing spellbound for a time one turned instinctively to see how Naples was affected by it all—from that distance, not an iota. As if in defiance or contempt of all these internal convulsions, the unbroken line of shore lamps twinkled as serenely as of yore, lighting the magnificent semicircular sweep from Pozzuoli round to Portici; but where they had formerly run on to Resina was a black gap, indicative of forsaken streets and ruined houses.

Later, during a lull in the eruption I managed to elude the vigilance of the guards, and during my wanderings over a part of the lava bed witnessed some most curious sights. A trio of chestnut trees, a week before in full leaf, but now withered and blasted by the molten showers, stood in an oasis as it were of a desert of half-cooled lava, and beneath their shade with outstretched wings and open beaks lay several tiny singing birds, quite dead. It was evident that they had first taken refuge in the branches and then, that failing, had fluttered to the ground only to be suffocated by the noxious gases drifting to and fro with the wind. Hillocks of dark sulphur several feet high were still burning with a ghastly blue flame, while now and again one encountered sheets and filaments of vitreous matter beautifully shaded in green and purple, for all the world like the finest Venetian glass—things of beauty wrought by the hand of destruction.

Gazing at the awful desolation that reigned around, one could not suppress a shudder at the thought of what might have happened had the eruption only increased in violence, or, as is not at all unlikely, had it been accompanied by an earthquake such as has shaken the Golden City of the West to her foundations. Then the world would have been witnesses of a tragedy a thousand times more terrible than that which overtook Pompeii and Herculaneum nearly two thousand years ago.

The Moral Instruction League.—This League, whose object is "to introduce systematic non-theological Moral Instruction into all schools, and to make the formation of character the chief aim of school life," has drawn up a very sound "Syllabus of Moral Instruction and Training in Citizenship," which has been adopted by some of the Education Authorities. We express no opinion whether moral instruction should be theological or non-theological, but whichever view our readers may take they are sure to find in this Syllabus much to help them.

COURSE OF LESSONS IN DOMESTIC SCIENCE.

THE CIRCULATION.

Step I. Preparation.—Briefly recapitulate a few of the points that have been established in the previous lessons:—(1) That chemical action is going on in every part of the body, causing heat to be generated, new tissue to be formed, and also giving rise to certain waste products; (2) That oxygen, which is necessary for this chemical action, is obtained from the air through the lungs; (3) That the other materials required for building up the new tissue are supplied by the food taken into the alimentary canal.

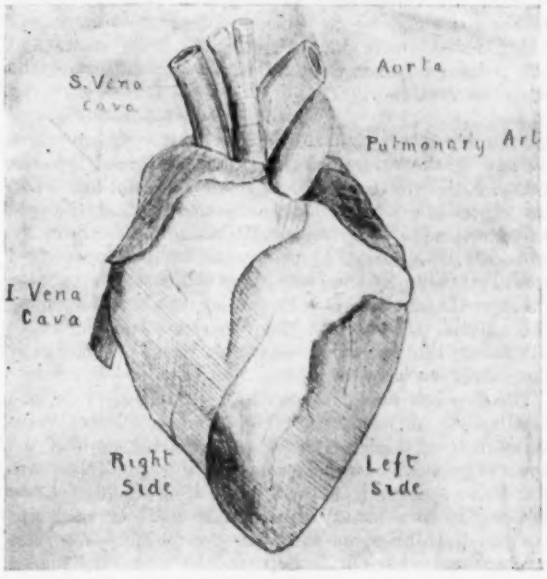
It is evident that we require some distributing agent, and this is found in the blood, which combines the duties of a Pickford's van with those of a municipal dustcart, for it conveys to every part of the system oxygen from the lungs and nourishment from the alimentary canal, at the same time removing the waste products and carrying them to the organs which effect their expulsion from the body.

Step II. Presentation: *The Blood.*—Blood is found in all parts of the body except a few tissues, such as the hair, nails, outer layer of the skin, etc. Every child is familiar with its bright red colour, and if a little is smeared on a slip of glass and examined under a microscope this colour is found to be due to a number of minute red bodies known as *red corpuscles*, which float about in a colourless liquid, the *liquor sanguinis*. These red corpuscles are so minute that three or four thousand placed side by side would only stretch an inch; but small as they are, the corpuscles have a most important duty to perform, for they are the oxygen carriers of the system. Here and there may be seen white corpuscles; these are slightly larger than the red and not nearly so numerous, the proportion being one white one to from four hundred to a thousand red ones.

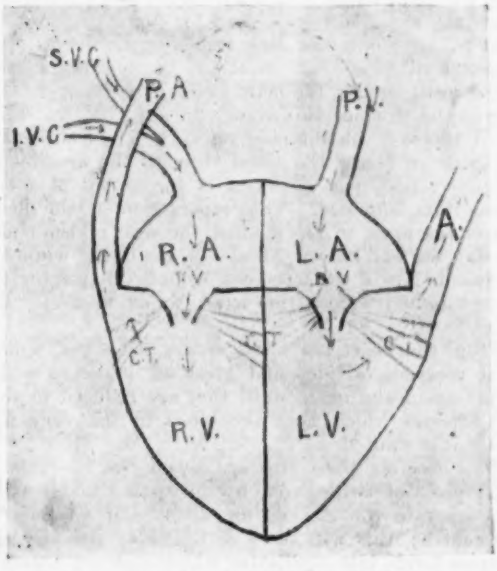
If you prick your finger and do not wipe off the blood it will form a clot which closes up the wound; this clotting or coagulation of the blood is due to the presence of a number of minute fibres which, when the blood is allowed to stand, form a kind of network enclosing the corpuscles, and giving rise to the clot.

The Heart is situated in the thorax or chest, slightly to the left of the medial line; its size is about the same as that of the closed fist. If possible, the structure of the heart should be shown by dissecting a sheep's heart before the class. The size and shape of the heart should be noted, and if the pericardium is still attached, this should be shown, and its shape as a double bag pointed out. In teaching before a class confusion is apt to arise as to which is the right and which the left side, so the heart should be held with the front (recognised by the seam of fat running obliquely from the base to about the middle) towards the class, in which case the sides correspond to the right and left of the teacher.

The pipes attached to the heart should be dealt with next. Most prominent of all is the *aorta*, the largest artery in the body; just in front is another not quite so large, the *pulmonary artery*; on the right are seen the two great veins, the *superior* and *inferior vena cava*; and to the left the *pulmonary veins*. Fix a piece of glass tubing into the superior vena cava and another piece into the pulmonary artery, then, after tying up the inferior vena cava, force water by means of a syringe down the superior vena cava and it will be seen rising in the tube fixed in the pulmonary artery;



any attempt to send the water in the other direction is fruitless. In the same way it may be shown that water can pass from the pulmonary veins to the aorta, but cannot pass in the opposite direction. Care-



fully remove the wall of the heart around the venæ cavæ and expose the right auricle; note the thickness of the walls and the opening in the floor leading to the right ventricle; force water suddenly down the pulmonary artery, and this opening will be closed by the

tricuspid valve being forced up by the rush of water; note the three flaps of skin forming this valve.

The left auricle should now be laid open in a similar manner, and water forced down the aorta to show the bicuspid or mitral valve, which has only two flaps.

The apex of the heart should now be cut right away, so that the valves may be seen from below, in order to show the chordæ tendinæ, which prevent the valves being forced back into the auricle. The aorta and the pulmonary artery should be laid open to show the semi-lunar valves.

The scholars should now be able to follow the course of the blood through the heart. Entering the right auricle by the venæ cavæ, the blood is forced into the ventricle by the contraction of the auricle, but when the ventricle contracts it cannot return, as the tricuspid valve closes, so it is forced into the pulmonary artery, and on the dilation of the ventricle it is prevented from returning by the semi-lunar valves. The passage through the left side is very similar, the blood entering the auricle, passing into the ventricle, and thence to the aorta, the return in each case being prevented by the valves we have examined.

Blood-vessels are of three kinds—arteries, veins, and capillaries. Arteries carry blood from the heart, veins carry it to the heart, and the capillaries connect the two. The walls of the arteries are thick and elastic to stand the spasmodic flow of blood from the heart and to bring it to a steady stream; the walls of the veins are much thinner, as they are not subjected to this strain; every here and there in the veins are placed valves to prevent the blood flowing back from the heart.

Step III. Association.—The circulation of the blood through the system may be compared to the distribution of water in a large town. Starting from the central station the water is pumped or forced into the "mains," which give off a number of branches which in turn divide and subdivide until the houses are reached. After the water has been used for domestic purposes, it is poured down the sink into a small drain pipe; these small pipes run together, getting larger and larger until, finally, the main sewer is reached.

Now, let us trace this system in our bodies. First of all, where is the pumping station? The heart is the pump which forces the blood through the arteries by its contraction, just as water is forced out of a ball when it is squeezed. This contraction of the heart causes the apex to tap against the wall of the chest, causing the well-known "beat" of the heart, while the spasmodic flow of the blood can be noted by placing the fingers lightly across the wrist so as to feel "the pulse."

From the heart the blood enters the aorta, which, as it proceeds, divides and gives off branches which divide again and again until they are reduced to very fine arteries which hold the blood in the very spot where it is wanted.

How does the blood give up oxygen, etc.?—Take a short piece of twine, and, by untwisting and teasing out, separate the strands for about half an inch in the centre; this will serve to illustrate the way the arteries divide into capillaries, which soon run together again, forming veins. The walls of the capillaries are so thin that an interchange can take place between the blood and the tissues through them, just as we saw in our last lesson that milk was able to pass through the bladder into the water. These little bundles of capillaries correspond to the houses in the water system of the city, for it is in these that the blood does its work of supplying nourishment and oxygen, and of gathering up waste products. Up to this point the blood has been a bright scarlet colour, but now it turns much darker, and is of no further use until it has been purified; it flows in a steady stream along the veins, which gradually run together, getting larger and larger, until the venæ cavæ are reached which lead into the right auricle. We have now traced the blood from the left side of the heart through the arteries, capillaries, and veins, back to the right side of the heart; this is the *chief* or *systemic circulation*, as it carries blood to almost every part of the system.

There are, however, two special circulations, viz., the *pulmonary circulation* and the *portal circulation*. The blood that reached the right side of the heart is deficient in oxygen, and loaded with carbonic acid gas, as is shown by its dark blue colour; so, before going round the system again, it must be purified by passing through the lungs. We have seen water pass from the venæ cavæ to the pulmonary artery, and from the pulmonary veins to the aorta. These show the two ends of the system, but between them the pulmonary artery breaks up into innumerable capillaries which are entwined about the air-sacs of the lungs, where the blood is purified before it is gathered up again and brought back to the heart by the pulmonary veins ready for another journey through the system. It will be noted that in the pulmonary circulation the arteries contain impure blood, and the veins pure blood.

The stomach, spleen, pancreas, and intestines have a special set of blood-vessels forming the Portal Circulation.

Step IV. Formulation.

The Heart.—Two auricles, two ventricles. No direct communication from right side to left side.

Openings between auricles and ventricles closed by valves. (Tricuspid on right; Bicuspid on left.)

Blood-vessels.—Arteries carry blood from the heart; have thick elastic walls. Veins carry blood to the heart; have valves at intervals. Capillaries are fine hair-like tubes with very thin walls.

Systemic Circulation.—Blood passes from left ventricle to aorta (cannot return owing to semi-lunar valves), carried by arteries to all parts of the system; small arteries divide into capillaries; these unite again as veins, and bring blood back to the right side of the heart, entering by the superior and the inferior vena cava.

Pulmonary Circulation.—Blood passes from right auricle to right ventricle, into the pulmonary arteries, through the lungs, and back to the left auricle by the pulmonary veins.

Portal Circulation supplies blood to the digestive organs.

Step V. Application.—The knowledge gained in these lessons should give the scholars some idea of the proper treatment of cuts and wounds requiring immediate attention. In all cases the clothing should be removed, and the wound carefully washed with cold water. If the blood is of a bright scarlet colour, and issues from the wound in spasmodic jerks corresponding to the beats of the heart, it shows that an artery has been severed. This is the most dangerous form of bleeding, and the thumbs should be pressed on the spot just above the wound, *i.e., between the wound and the heart.* To bind up the wound tie a pad (such as a roll of linen

or a cork) tightly across the artery, choosing, if possible, a spot where the artery can be pressed against a bone; thus for a wound in the forearm the pad should be applied about the middle of the upper arm where the artery can be pressed against the humerus, while the groin is the best spot for controlling the arteries of the leg. When a vein is severed the blood flows quite regularly, and is of a darker colour when it first issues; in this case pressure must be applied on the side away from the heart.

NOTES ON AN EXPERIMENTAL COURSE OF LESSONS ON PLANT LIFE AND SOIL.

BY EDWARD J. RUSSELL, D.SC. (LOND.),

Lecturer in Chemistry, South-Eastern Agricultural College, Wye.

(*Continued from p.* 580.)

THE FEEDING OF PLANTS.

Importance of the Air.

PLANTS cannot develop normally, or even long survive, without air. It was shown in the experiments on air and water (Experiment 46, March 1905, p. 459) that vigorous plants like nasturtiums or beans will live for several weeks in bottles from which all the air has been exhausted, but the plants then take on a very abnormal appearance, and evidently do not find their surroundings suitable. It is also quite easy to show that plants will not grow in an atmosphere of nitrogen, and that only when oxygen is present can they make proper development. In this respect plants behave like all other higher organisms.

We have now to deal with a very remarkable property of plants of the highest importance in the economy of nature, and one in which they differ fundamentally from animals. The animal must have its food ready made. Carbohydrate and proteid materials must be fully formed before they can be used; the animal's digestive system will then break down these food stuffs into simpler products which are absorbed into the animal's body. Some of these are retained, some are burned or "oxidised," and heat is given out. The animal, in short, is a destructive agent so far as food is concerned; he has little if any constructive power; the protein in the sheep we eat was protein (or something closely allied to it) in the herbage on which the sheep lived, the fat in its body was fat in the linseed oil cake (or other food) given to the animal, or was obtained from more complex carbohydrates. The plant, on the other hand, is a constructive agent. It is provided with apparatus which has no counterpart in the animal system, by means of which it can build up or "synthesise" carbohydrates and protein from the simplest materials. When it has made these foods, it may break them down again in much the same way as an animal does; part is transferred to places where growth is taking place, to be built into the plant itself; and part is burned or oxidised, forming carbonic acid and water. Energy is required for the constructive process; this is obtained from the sun's light and heat.

Three of the constructed or "synthesised" products have been investigated—starch, sugar, and protein. For school purposes, starch is the simplest substance to work with.

Dependence of Starch Production on Carbonic Acid.

Experiment 51.—Fit a test tube with a good cork split longitudinally. Put a little caustic soda solution in the bottom of the tube, taking care not to wet the sides; use a pipette for the purpose if you have one. Obtain a healthy plant of barley, oats, wheat, or grass, the leaves of which are still sufficiently young to show the starch test with iodine. Clip a leaf between the two halves of the cork, introduce it carefully into the tube, and cork up as tightly as you can without injuring the leaf; take care, too, that the leaf does not touch the caustic soda. Support the tube in such a way that the leaf does not get broken off from the plant. Fix in the same way on to another leaf a tube containing no caustic soda. On the following day cut off both leaves and test for starch. The leaf in the tube without caustic soda is found to contain starch; the other, which has been deprived of carbonic acid, does not.

Use the starch test of Experiment 30 (p. 469). Kill the leaf by dipping for a few moments in boiling water, then warm with methylated spirit, and repeat the process till the leaf is colourless. Dip into a solution of iodine in potassium iodide; the starch in the leaf produces an intense blue colour.

It was shown in the experiments on air and water that caustic soda absorbs carbonic acid quickly and completely; the atmosphere in the test tube was therefore quite free from this substance, and the result is that starch is not produced.

Dependence of Starch Production on Light.

Experiment 52.—Take two fairly equal plants in pots, or select two in the open; cover one with a tin can to exclude light, leave the other alone. After a day or so, pluck leaves and test for starch. This is only found in leaves which have been exposed to light.

Experiment 53.—Having found that the leaves contain no starch, leave the plant exposed to sunlight for a short time. After fifteen or twenty minutes, pluck another leaf and test for starch; it has usually appeared by this time.

The formation of starch is a wonderful and inexplicable process from beginning to end, and not the least wonderful feature is the very short time required in the above experiment. Usually the rapid carrying out of a reaction requires a high temperature, but here it goes quickly at ordinary temperatures.

Experiment 54.—Take two corks of the same size, pin them together one on each side of a growing leaf still attached to the plant. After two or three days, test for starch; the part covered by the cork contains none, and remains unstained by iodine, the exposed part shows the characteristic deep blue colour.

Nasturtium leaves are well adapted to this experiment.

Experiment 55.—The experiment may be varied by cutting out a device in black paper, and fixing on to a large leaf, or separate letters may be fastened. "Prints" from a photographic negative have also been obtained.

Brown and Escombe have shown that starch is pro-

duced more readily in diffused daylight than in strong light: this is also borne out in green-house experience.

Dependence of Starch Production on the Green Colouring Matter.

Experiment 56.—Apply the starch test to any variegated leaf you can find. The variegation no longer shows after treatment with methylated spirits, but it at once becomes apparent when the leaf is dipped into iodine solution.

The formation of starch is thus seen to be very local; only the green cells (the chlorophyll cells) have the power of producing it, other parts cannot. Plants which are not green, *e.g.* Broom Rape, Dodder, Mushrooms, Toadstools, cannot make starch, and are just as dependent on other plants, or on ready-formed organic matter, as animals are.

Heat is necessary for the process, but the temperature required varies for different plants. In winter the above experiments may sometimes break down from this cause.

It appears from the experiments made by Brown and Morris that, in certain cases at any rate, the formation of sugar precedes that of starch. The plant uses up as much sugar as it requires, and the rest is stored up as starch in the leaf. But the starch does not remain there long; in the night time, when its formation ceases, the plant draws on the reserve accumulated during the day, and the teacher who is energetic enough to gather leaves before daylight will find them free from starch. It is not necessary, however, to adopt any heroic measure to establish this point. If a plant which is found to contain starch is covered up late in the afternoon with a large tin or bucket, the test may be applied at some convenient time the next day.

The experiments given in the last and in the present number enable us to form a coherent idea of the food of plants. Oxygen, carbonic acid, nitrogen compounds, and various mineral substances are all essential.

Carbonic acid is taken in by the green parts of the plant under the influence of light and heat; it is made, by a process peculiar to these particular cells, into starch. The starch then serves as food for the plant just as it would for an animal.

Nitrogen compounds are taken in at the roots; they are built up somewhere in the plant into protein, but the process is scarcely at all understood, and is not suitable for school demonstration. But the water cultures and sand cultures of Experiment 50 show that all plants, with the single exception of the Leguminosæ, are absolutely and entirely dependent for their supplies of nitrogen on compounds in the soil, so far as is known. No plants (if we except certain unicellar and microscopic organisms) have the power of taking nitrogen from the air; even the Leguminosæ are dependent on the nitrogen compounds produced by bacteria living in the nodules on their roots. The nitrogen compound used in Experiment 50 is one of the simplest known; it would be useless as food for animals, but the plant can build it up into complex protein material which is useful for animal food.

SCHOOL JOURNEY TO WINCHESTER.

HORNSEY HIGHER ELEMENTARY SCHOOL.

BY DR. H. E. PIGGOTT.

THE School Journey to St. Albans, which has already been described in the *Practical Teacher*, was first undertaken by the First Year scholars of 1904, the year in which the school was opened. It was preceded by several visits to historic places in London. All these ventures were so arranged as to form an important and organic part of the teaching in History and Geography, and they proved so successful and valuable as instruments of sound and broad education, that not only have they been repeated and extended with the First Year scholars of 1905, but further pioneer work has been undertaken by the teachers and scholars of the Second Year—scholars aged about thirteen years.

The History course for the Second Year embraces British History to about 1450 A.D. By October the scholars had discussed the history to the time of Magna Charta, and the problem as to the most valuable objective for the School Journey was easily narrowed down to a consideration of the relative claims of Canterbury and Winchester. Both possess most interesting and important historic associations, extending from very early times over many centuries; both present magnificent specimens of architecture, and in both are to be found very substantial remains of city walls and feudal strongholds. Of the two, however, Winchester fills a much more prominent place in Anglo-Saxon and Early English history, having been the ancient capital of England. Its cathedral, moreover, gives excellent specimens of the earliest Norman architecture in England, and has the singular advantage of showing how Norman could be, and was, converted into Gothic architecture.

But practical matters have some weight, and questions of time, money, and safety forced themselves into the consideration. The difficulties of transit to both places were much greater than on visiting St. Albans, since the scholars were to be taken across to South London before beginning the journey proper—and this between 8 and 9 A.M., when trains are crowded. On inquiry, it was found that these difficulties and the fares were practically equal in the two cases, but that the duration of the journey was very much less in going to Winchester than in travelling to Canterbury. The available time in the latter town would necessarily have been very short. This decided the matter, but much time was taken before the arrangements were completed; indeed, the quotation of prices from the Great Western Railway reached the school four weeks after the journey had taken place! The London and South-Western Railway officials were prompt and courteous, and offered to take us for single-fare return for adults, half single fare for scholars. But the means of reaching Waterloo from Harringay by 9.15 A.M. were not so easily determined. The use of special buses or brakes from Harringay or King's Cross was much too expensive. Finally cheap return tickets to Moorgate Street on the single-fare scale were obtained, but the City and Waterloo Railway refused any concessions, and have no reduced fare for children.

The organisation of affairs in Winchester would have been even more serious, but that I knew the town fairly well, and was most fortunate in possessing a good friend

in Mr. Elenor, headmaster of the Wesleyan School at Winchester. He very kindly made arrangements for tea, and suggested the day's itinerary.

In the school frequent reference had been made to the journey, and scholars had discussed ways and means with their parents. On October 25 a detailed notice was posted in the school, with full particulars of the journey, which was arranged for Friday, October 27. The total cost per scholar was four shillings. This covered all fares, entrance and other expenses, and tea. Many names had already been given in, and much classroom preparation had been completed. A clear map of Winchester, with brief notes on its history, was cyclostyled, and on the reverse of the sheet was added a plan of the Cathedral, with notes and illustrations of the development of its architecture. These sheets were distributed among the scholars, and on Thursday afternoon further explanation was given with the aid of a set of lantern-slides. All the details of journey and visit were fully discussed.

Of the 115 scholars in the Second Year, 63—including the whole of the first class (32)—decided to go to Winchester.

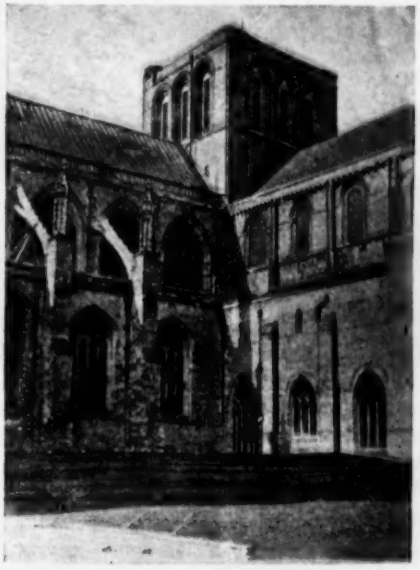
Six adult teachers accompanied them. The scholars were grouped in sixes; each group chose one scholar to act as leader. Two such groups were allotted to each of five teachers. Those scholars who were unable to visit Winchester were taken by other teachers to the Tower on the Friday afternoon, the special Moorgate Street tickets serving for this purpose also.

On the Friday morning the scholars took train soon after 8 A.M. in groups of twelve, at five different stations in Hornsey, and in different trains. They walked from Moorgate Street station to the Bank, and then travelled by the City and Waterloo Railway to Waterloo, arriving at 9 A.M. After ascertaining that all were in attendance, the number and date were filled into the order form, and a ticket for the party was obtained at the booking-office.

The journey down was fast and all too short. It was an ideal morning; the Downs were in their best autumn garb, the country was new and strange to many scholars, all had so much to see and say and eat that the time was quite inadequate for these purposes. At 11.30 we reached Winchester, and found Mr. Elenor, who sacrificed to us a day's holiday, waiting upon the platform. The visits began almost immediately, under his excellent guidance.

Directing us along a path beside the railway, he soon brings us to the huge, flat stone which now bears an obelisk erected 1759, in memory of the days of the Plague in 1666, when people brought food for the inhabitants of Winchester, and placed it upon this stone. The afflicted people would come out by the old West Gate near by, remove the food, and leave the value in money dropped, as some say, into basins of vinegar on the stone. Passing the West Gate on the outside, we snatch a fine glimpse of the High Street through the gateway away down the hill, and then soon reach the great hall of the old Castle, built 1235 A.D. The caretaker explains at length how it was used for four centuries in early times as the meeting-place of English Parliaments, and later as a Court of Justice. Sir Walter Raleigh was tried here. High up on its western wall hangs the huge wooden table-top, 18 feet in diameter, reputed of Arthur, and from Tintagel; its lettering, the painted figure and roses, are still quite clear. Below this in the wall is a curious hole and small passage, which was probably used as a means of listening secretly to the discussions and trials in the hall, and may have served as a speaking-tube. The hall is still in great demand for banquets and meetings. Reluctantly breaking into a learned discussion concerning the claims of the table to be Arthur's, we make our way back, and resolutely, though with regret, pass by the inner side of the West Gate, with its staircase leading to the well-stocked museum. We hope to visit it on our return.

We are next conducted down the High Street to the elegant City Cross, 43 feet high, erected probably by Cardinal Beaufort in Henry VI.'s reign. It bears four



WINCHESTER CATHEDRAL FROM NORTH-EAST.

large figures, one of which represents Alfred the Great. The old house on the west side of the corner in which the cross stands occupies the site of the Conqueror's palace, and still preserves its cellars. Almost opposite is the spot on which stood the palace of Great Alfred's Queen. The surroundings teem with historic associations, and every house boasts its ancient name and place. A short turn to the right brings us to the entrance of a fine avenue of trees, leading to and presenting a most picturesque view of the west front of the Cathedral. Assembled upon the fine stretch of green sward rising gently in front of the Cathedral, the party gaze upon the huge west window, with the bishop's balcony at its foot, resting on the very apex of the low central doorway, and rising to the lower level of the gable. This last is surmounted by a niche containing a statue of William of Wykeham, the great builder. Simple almost to plainness, the front has nevertheless an impressive effect upon the starved eyes of the London scholar. Awful in its massive grandeur and silence, peaceful and beautiful in the seclusion of its ample close and patriarchal trees, the Cathedral casts a spell upon us for a few moments, and then questions arise, curiosity leads young feet astray, quaint epitaphs are discovered, and time flies apace. Before entering the building the first group photograph is taken, with the Cathedral in the background.

Once inside, the vastness of the Cathedral becomes more evident; an interior view 130 yards long may be had from the west entrance. The massive Perpendicular piers, fashioned by encasing the older Norman pillars, give the appearance of a solid and continuous wall of stone, as one looks away beyond choir screen and altar screen to the east window. Here our official guide joins us, and two long hours of liberal education and interesting experience begin. Facing about we see the west window in a new light, glazed in patchwork style, without order or design, with

WINCHESTER CATHEDRAL: NORMAN ARCHES.

fragments of rich glass from the window destroyed by the Parliamentary soldiers. We then proceed down the nave to admire those wonderful chantries of Wykeham and Edington and the Norman font, *c.* 1150 A.D., "the most remarkable of all the treasures," with its quaint carvings. Next, having paid our composition fee, we pass into the south transept. Here the rugged grandeur and rude strength of the early Norman work scarcely needs to be pointed out even to children. The Norman characteristics having been grasped, the romance of Wykeham's reconstruction, by which he converted Norman into fine Perpendicular, is recited. The contrast between the old style as retained in the transepts and the tower, and the new in the nave is most striking; while on every hand, evidences of the change and the means adopted—encasing pillars, pulling down arches, screening with later work, neglecting obscurer parts—are numerous and interesting.

We move on to the altar screen, wonderful beyond description, to those quaint chests containing the bones of Great Canute and other Saxon and Danish kings, whose names now assume something of reality, and to the grave of Rufus under the huge Norman tower. This tower is very remarkable with its massive masonry and enormous pillars, built to defy the ages, for its predecessor kept vigil over the king's tomb but seven years after his burial, and then collapsed in ruins. Soon we reach the eastern portion, containing the fine work and delicately sculptured stone of Fox's, Cardinal Beaufort's, and Gardiner's chantries, and the Ladye Chapel with its exquisite wood-carving and its wall paintings. Our guide, however, moves steadily onward, and, as a special favour, takes us down into the crypt and shows us the old Saxon stone-work and arches of an extensive building, dimly lighted and once a place of worship, now bearing up the mighty superstructure. Here also is the ancient British well, circular, about 2 feet in diameter and 10 feet deep, and still full of clear water.

Reluctantly the adventurous spirits are led back from these dim passages and vaults, and filing slowly and unwillingly along the north aisle, past Jane Austen's memorial tablet, we reach the outer air and light.

By devious paths we hurry on past the Deanery to Wolvesey Castle—beautiful ivy-covered ruins where Alfred once had his palace. Here a short halt is called to rest on the grass in the warm sun, to finish lunch, and to take photographs of the ruins and the distant Cathedral among the trees. Our next goal is St. Cross Hospital, which lies a mile out of the city. The path lies along the bank of one branch of the river, which here, in the flat, alluvial valley divides, rejoins, and meanders with many streams in the meadows. This scene fills out many geographical notions. The surrounding hills suggest the rapid gathering of waters after rain, the traces of flood and overflow are not wanting, the necessity and nature of river banks in level lands are clearly demonstrated. Ancient water-mills, with their weirs, sluices, and paddle-wheels, are passed on the way. On our left rises St. Catherine's Hill, bald, save for a central tuft of trees, and crowned, though rather low down, with the enormous earthworks which once protected the old British city.

Now we approach the ancient walls of St. Cross, and already see awaiting us at the gate the genial Master, the Hon. and Rev. Canon Brodrick. We are heartily welcomed, and at once made to feel very much at home and very interested. The hospital is a very old foundation, established by Bishop Henry de Blois, 1136, for "the poorest of the poor," and repeatedly re endowed, enlarged, enriched by successive Masters. Cardinal Beaufort designed a new foundation, to be called "The Almshouse of Noble Poverty," but misfortunes consumed its revenues, and only two additional brethren were permanently added. The spacious gateway under Beaufort's Tower admits us to the porter's hatchway, where bread and beer are doled out to callers. We then pass into a spacious quadrangle, round which lie the brethren's dwellings, hall, infirmary, and church. This last we visit first, and soon find our guide to be an enthusiast. Almost an hour is spent in the church, and not one moment is dull or wanting in instruction. The canon has done much to restore the old church, and knows the story of every cleaning, scraping, and restoration. Beauties of wood and stone are pointed out, broad hints of hidden treasure are given, features of structure and ornament are noticed and admired. In a similar manner we are conducted through the old kitchen, with its huge fireplace and ancient utensils, and into the great dining-hall, with its raised hearth in the middle of the floor and its leathern jacks. Cardinal Beaufort's lantern still swings aloft, and near by are the antiquated leathern fire-buckets. The canon is untiring, and we never get tired. Finally nothing remains to be seen but the canon's garden and ancient fish-pond. This is a rare privilege, not to be missed. Cameras are busy here. We are indeed loth to part from St. Cross and its delightful canon, but the way back to tea is long and time short, so we depart, after receiving a promise that gladdens the heart,

and stirs anticipations which must live a year to be realised.

Having retraced our steps to the town, we cross the canal, and find ourselves in the quarter of ancient water-mills, weirs, and rushing streams. At length we pause again in the High Street to make our last observations and remarks. In the wide, open Broadway stands the latest addition to Winchester's historic treasures—the statue of King Alfred (1901). The huge bronze figure, elevated upon an enormous block of stone, is admirable, and in the failing light of this

WINCHESTER: STATUE OF KING ALFRED.

peaceful evening it makes a deep impression, which goes far to strengthen the feeling of Alfred's greatness and majesty.

Now we draw wearily back to the station, near to which we are much refreshed by an excellent tea. Our fast train reached Waterloo at 7.30 P.M., and by 8.30 each boy and girl was safely restored to the family circle.

The journey was most successful, and the scholars returned the richer by many valuable experiences and happy memories; but the limited time compelled the omission of much that was most interesting. A week were little enough in which to see the town and its surroundings. Inquiries were set on foot with a view to some scholars staying a week-end or spending Easter week in Winchester, but this was postponed.

During the week following the excursion the scholars wrote letters in their spare time to the Dean of Winchester, Canon Brodrick, or Mr. Elenor, as they preferred, in which they detailed at considerable length their experiences during the visit. These were sent on to the gentlemen for whom they were intended, and were read with much interest. The writers of the best letters in each class received free copies of the photograph taken in the Wolvesly Castle grounds.

COMMON-SENSE NEEDLEWORK.

BY MISS FLEMING,

Authoress of "How to Teach Needlework," "Pupil-Teachers' Needlework," "Sewing-class Guides," etc.

SEAMING, SEWING, TOP-SEWING, OR OVER-SEWING.

THESE are all practically the same. The word "seam" is usually applied in conjunction with the word "fell," and always indicates that two strips are to be connected.

The folded edges of two pieces are placed together to form a join, and the needle is passed through both. That makes the strongest stitch in plain needlework. It is worked from right to left on the *right* side of the garment. It is also applied to selvedges when joining gores, pillow-cases, &c., but it is not advisable to allow learners to use them, as they are often stiff and uneven.

The stitch itself is like the letter N, the dotted lines of which show where the needle has gone through and under the material, and the thick line where the thread crosses the top of the folds.

Careful fixing is very important. The first turn is narrow, the folds lie quite flat, and both the edges to be seamed lie evenly side by side.

Every girl must be provided with strips of calico fixed during a previous lesson, needle, cotton, and thimble. The teacher's demonstration specimen should be large enough to illustrate all the working—a darning needle will be more easily seen than a short one.

The teacher will accentuate the following points, and pattern the methods several times, if need be, every eye meanwhile watching her movements.

1. The work is to be placed round the *end* of the first finger of the left hand, the hand itself being on the top of the work. The thumb and middle finger hold the work in place.
2. The needle is pointed straight to the chest.
3. Only a tiny piece of the material on both sides is to be taken up on the needle.

The methods adopted when teaching hemming must be strictly followed, *i.e.*, the teacher shows how the stitches are made, using at first the drill for every movement, and emphasising the fact that the needle is to be pushed by the thimble quite through both folds with one movement. Then the class tries to imitate her.

The class instructions will be:—

1. Place work round end of finger.
2. Put needle to thimble.
3. Let cotton come between second and third fingers.
4. Point needle to chest, taking up a tiny piece of each fold.
5. *Push* the needle through with the thimble.
6. Draw out the needle, at same time letting cotton slip again into place.

When the method of applying the drill is understood, the teacher will herself sew for a while, the class watching her to catch the rhythm of the movement. The order, "go on sewing," or something to that effect, will be given, which means that the class must put the needle backwards and forwards regularly and systematically, *without looking up*, until told to stop.

This not "looking up" is more important than would

be supposed. It is not simply a question of discipline. It means training of "hand and eye" to fine issues, the former in skilful execution, the latter in minute observation. The "swing" or "rhythmical" movement will produce a certain amount of regularity of work, but if the eyes be constantly turned away on the completion of a stitch, they are not quick enough to detect, on returning to the work, the very slight variations of slope and distance which such an act causes, and so irregularity is the result.

The teacher will stand in front of the class to notice the attempts made, and to find out how far the instructions have been followed. After a while she will stop the class and go through each step again, following up her corrections with the *patterned, mechanical, regular movement*. The class goes on again, the teacher meanwhile silently criticising individual girls.

After a little longer time has elapsed, during which no girl must be allowed to lift eyes from her work, the class will again be stopped for further corrections and explanations.

Faults in Seaming.

As all such verbal terms as "too much," "too little," are comparative, and B.B. diagrams (which, however, should be freely used), are only relative, hence it becomes imperative that a suitably worked specimen should be in front of each child, so that she may refer to it as an exact copy of what her work should be. Common faults are:—

1. *Not holding the work properly.*—The left hand must be on the top of the work, which is all kept underneath except the part which goes round the finger.

2. *Puckering.*—This is caused by not inserting the needles at a right angle with the work. Should it enter at any other angle it takes hold of a longer piece of one edge than of the other, which causes puckering. It must be pointed straight to the chest.

Faults 1 and 2 can be detected by the teacher as she stands in front of her class.

3. *Taking too much on the Needle.*—Only a tiny piece of each fold is to be taken up on the needle. If it be put too far down on both sides, a ridge is made which no amount of stroking will quite flatten. If deeper on the one side than the other the stitches are irregular.

4. *Stitches too widely spaced.*

5. *Irregularity* in size, shape, and spacing.

The faults referred to in 3, 4, and 5 cannot be detected by the teacher from the front of the class, but she will be acting wisely not to leave her place. She must keep her eyes on the class all the time, to see that the girls are not looking up, which she cannot do if passing in and out of the desks. She knows by experience that certain faults will be committed, so she must be prepared to tackle them. In order to do this she must secure the co-operation of her class, and make use of those critical faculties which children possess to a larger extent than older people often suspect. She should, therefore, bring the power to criticise into operation, by requesting the girls to look at their work closely, to find out how it differs from the specimen. She will refer to the deep ridge, which may be caused by No. 3, and asking all to put up their hands who have taken too deep hold, will insist upon a closer inspection before a fresh start is made.

After they have worked long enough to give them a chance of improving, she will stop the class again to ask who have done better.

When she has satisfied herself as far as that point is concerned, she will follow a similar plan with regard to the spacing in No. 4.

The irregularity of stitches referred to in No. 5 will be eventually overcome by looking intently at the copy and then keeping up the sewing movement.

The seaming is not to be considered finished until the tacking threads are taken out and the seam stroked flat.

When the pieces are collected, the teacher should study them all, so as to find out what faults are most common. She will then be in a position to make the next lesson serve a useful purpose.

Commencing (a).—When putting the needle in for the first time, the fold nearest the worker is taken; the cotton is drawn through, until about half an inch is left lying on the top of the seam between the folds. This is held firmly with the thumb of the left hand until two or three stitches are made.

(b) Another method is to put the needle in between the two folds as described above, and turn the work round and sew backwards four or five stitches, then turn it back again and sew over the stitches thus made. This method is particularly advisable where the ends of seams require to be very strong and when joining selvedges.

Joining.—If no end of cotton is left, three or four stitches must be undone and the end of the cotton brought out between the folds. New cotton is begun as described above in (a), only there will be two ends of cotton instead of only one to sew over.

Or, the needle may be inserted between the folds in a backward direction under a few stitches, which are then sewn over.

Felling differs from hemming only, in being applied in conjunction with a seam, where two pieces of calico are joined together and the double fold is sewn down to a single piece. It is worked precisely as the hemming stitch. Unfortunately, girls very often get the notion, that it need not be so neat as the former stitch, and not uncommonly the seaming is well done and the felling is poor. It is a good plan to draw attention to the fact that both seaming and felling stitches should be alike in size and spacing.

Run and Fell Seam.

This is a method of joining two pieces of material together. It is a quick way of doing up lengths of light, loosely woven material; but unless the girls are carefully watched the stitches often develop into coarse, slovenly work. Both pieces are cut straight, and placed with the right sides inside and facing each other. The edge row of the back piece should stand a little way above that of the front. The back one is then turned over, so that a fell is formed. It is tacked firmly just above the raw edge to keep the fold in place. The running stitches are made immediately below the raw edge, which will be a guide in keeping the stitches straight. The running stitches must show through clearly on the wrong side. If the material be soft and fine, two or three or even more stitches may be taken up on the needle at once.

When the running is finished the tacking threads are not to be removed, as they will keep the fell firm. The material must be opened out, and the fell *tacked* down and made to lie quite flat. It is the omission of this that so often forms a difficulty. If it be felled without first tacking, it is probable the back

will be found to be puckered and folded over. Both sides must be quite flat without any fulness. The felling should be neat, and the hemming stitches the same size as the running ones.

Felling is exactly the same as hemming, but the material is usually more clumsy to hold, and thus it is often not so well worked.

A Counter Hem, though bearing that title, is actually a seam, because two pieces are joined together. It may be used by very young children who have not learnt the more advanced seam stitch. It forms a perfectly flat seam, consisting of two sets of hemming stitches, worked one on the right and one on the wrong side.

A narrow turn, about a quarter of an inch deep, is made on the right side of one piece and on the wrong side of the other. The folds are placed face to face, so that they lock into each other. They are tacked firmly, so that when each side is worked the distance between the two rows of stitches will be about that of an ordinary seam and fell. Both right and wrong sides are hemmed, and a flat seam is then the result. Both lines of stitches should look regular and even.

It is used for pinafores, skirts, under-bodices, &c. It may either be machine-stitched or backstitched, when both rows of stitching would be done on the right side.

Mantua Maker's Hem, or Hemmed Double-Seam.

This, like the Counter-Hem, is really a seam, as it is used for joining.

It is applicable to pinafores of fine muslin, silk, or any thin material, as it is quickly done, presents a neat appearance on the wrong side, and has only the working line between the folds visible on the right side.

Both raw edges are placed together with the right side inside and the back piece projecting a little above the front piece.

The upper edge is then folded over the lower one.

This double fold is then turned over again to form a narrow hem, and tacked securely in place. It is hemmed through *all the six thicknesses*, the stitches showing clearly at the back, which, like the front, is on the wrong side of the garment.

When finished, an upstanding fold is left on the wrong side, while on the right side no stitches are visible—the join only can be observed.

Double French Seam.

This joining is used for pinafores, frocks, and bodices made of muslin, print, or other loosely woven material, whose edges would easily fray out. Like the mantua maker's hem it has only the working line between the folds visible on the right side.

The two raw edges are placed together, having the wrong side inside and the right side outside.

These are tacked firmly and run evenly below the tacking thread, which is removed when the running is finished.

The work is now turned inside out, and tacked again so as to enclose the raw edges.

The *right* side is now inside, and the tacking threads must be so placed that when completed no raw edges show below the stitches. The seam is completed by running, backstitching, or a run and backstitch, or machining. No stitches are to be seen on the right side, and the wrong side has an upstanding, double fold of material.

THE HISTORY OF THE BRITISH ARMY.

By the Author of "Practical School Method Notes," etc.

IN the March number of the *Practical Teacher* we traced in outline the glorious history of the British Navy, our "first line of defence"; in this article we propose to take a retrospect of the splendid achievements of our Army, the "second line of defence." Owing to our insular position we are obliged to rely more on our Navy for purposes of defence than on our Army. In other countries, *e.g.* France and Germany, the army takes the first place.

The British Army at the present time is in a somewhat chaotic condition, owing to the transition which it is undergoing. It has, however, a magnificent record. But before dealing with its history it will be as well to consider the duties of the Army at the present time. These have been admirably summed up by Sir Charles Dilke and Mr. Spenser Wilkinson in *Imperial Defence*, as follows:—

1. Garrisons for naval bases.
2. A garrison for Great Britain against invasion by *coup de main*.
3. A garrison for India, with a reinforcement ready when required.
4. Imperial police.
5. Counter attack on an enemy's territory after the command of the sea has been won.
6. Resistance *en masse* against invasion in the extreme case of naval disaster.

In taking a retrospective view of the military history of Great Britain, we are confronted with the same difficulty as when treating of the naval history of the country, viz., the vastness of the subject. Owing to the exigencies of space, we are therefore compelled to condense it within narrow limits, and to give only the essential outlines.

The military history of our country is capable of a twofold division: (1) the military organisation before the introduction of standing armies, and (2) the military organisation subsequent to the introduction of standing armies.

I. The Fyrd or Militia.

Under the Ancient Britons there was no military organisation whatever, although they were capable of offering considerable opposition to the landing of the Romans under Julius Cæsar in B.C. 55.

In Saxon times there existed what was known as the *trixoda necessitas*, which comprised the three duties of every Saxon citizen: (*a*) the repair of the bridges, (*b*) the repair of the fortifications, and (*c*) military service. By the terms of the *fyrd*, or militia, every man had to appear fully equipped and armed when called upon.

Canute, when he became King of England, introduced some mercenary troops known as *huscarles*, which force formed, as it were, the king's body-guard.

When William I. attempted the invasion of England the English army was in a very efficient condition. When he landed on the southern shores of the country Harold was engaged in the north fighting against Tostig, whom he utterly routed. While the troops were enjoying the fruits of victory, news was brought

to Harold that Duke William had landed. Immediately on receipt of the news Harold and his troops hurried south. When they came face to face with the Normans they were placed at a considerable disadvantage, for they were fatigued with their previous fighting and the subsequent long and forced marches. After a stubborn fight the Normans gained the victory.

II. The Army in Mediæval Times.

The establishment of the *Feudal System* gave England a strong and efficient army. The land was divided into a number of "feuds" or "fiefs," and these were given to the Norman barons on the condition of military service. "The exact obligation of the knight's service was to furnish a fully-armed horseman to serve at his own expense for forty days in the year" (*Dr. Stubbs*).

We must not forget that, in addition to the feudal army, there was also a militia force, which was called the *posse comitatus*. This force acted under the sheriffs of the county, and every man between the ages of fifteen and sixty was enrolled in it. The militia force, it should be noted, was employed for home defence, *e.g.* against the invasion of the Welsh or Scots.

The Assize of Arms (1181) was enacted in the reign of Henry II., by which all the freemen of the country were to provide themselves with a certain quantity of arms and armour according to their means. This Assize, says Stubbs in his *Constitutional History* (vol. i.), was intended "to reform and re-arm the national force of the fyrd."

It was in the reign of Henry II., too, that scutage was introduced. Scutage, or shield money, was a "pecuniary commutation for personal service." Many barons availed themselves of the opportunity thus afforded for the payment of a sum of money in lieu of military service. This arrangement was also very beneficial from the king's point of view, for the sum thus obtained enabled him to employ mercenary troops to fight his battles. The introduction of scutage, it may be noticed in passing, was one of the causes of the decay of feudalism.

John employed mercenary troops, and it was partly through the unpopularity that arose from their employment that the barons assembled in arms at Runnymede.

During the Plantagenet period the military genius of Edward III. and Henry V. were conspicuously displayed. In the reign of the former occurred the victories of Crecy (1346) and Poitiers (1356), whilst in that of the latter the Battle of Agincourt was fought (1415).

III. The Introduction of Gunpowder.

When gunpowder was introduced into England as a means of destruction, the whole science of military organisation was revolutionised, just as the introduction of steam and ironclads brought about a new science of naval warfare. The introduction of gunpowder had a levelling tendency, "and created a thorough change in the social organisation of Europe." For the manifold results which accompanied the introduction of gunpowder the reader is referred to Dr. Zerffi's *Studies on the Science of General History* (vol. ii.).

IV. Cromwell's Army.

It is to Oliver Cromwell that we really owe our standing army, although a standing army had not yet been made legal. It was he who saw that a well-trained and efficient army was necessary if the Parliamentary army was to be victorious in the Civil War. This conception rapidly assumed a concrete form, and, as it happened, the material was ready to hand. Religion was at the foundation of this idea, for Cromwell was of the opinion that only men of religion would be able to withstand the "men of honour" among the Cavaliers. The achievements of the Cromwellian army have been thus described by Dr. Firth in *Cromwell's Army:* "It had propagated democratic principles, and imposed religious freedom with pike and musket; it had initiated many interesting political experiments, and drawn up four constitutions. In time the aims which it had at heart were to be realised by other hands and by more appropriate methods."

Mr. Morley, in his admirable biography of Cromwell, describes his military genius in these terms: "In speed and vigour, in dash and in prudence, in force of shock and quick steadiness of recovery; in sieges, marches, long wasting campaigns, pitched engagements; as commander of horse, as tactician, and as strategist, the modern expert ranks Cromwell among the foremost masters of the rough art of war. Above all, he created the instrument which in discipline, skill, and those highest military virtues that come of moral virtues, has never been surpassed."

The *New Model*, as Cromwell's army was called, formed the nucleus of that army which was, later on, to achieve such successes on the Continent, and, still later, to lay the foundation of a magnificent and extensive colonial empire.

It was enacted in the Bill of Rights, which became law in 1689, "That the raising or keeping a standing army within the kingdom in time of peace, unless it be with the consent of Parliament, is illegal." By this Act a standing army became legally established. The Mutiny Act was also passed in 1689, and must be passed every year, otherwise the army would be dissolved. "If the king," to quote the words of Hallam, "were not to summon Parliament every year, his army would cease to have a legal existence; and the refusal of either House to concur in the Mutiny Bill would at once wrest the sword out of his grasp. By the Bill of Rights it is declared unlawful to keep any force in time of peace without the consent of Parliament. This consent, by an invariable and wholesome usage, is given only from year to year."

V. Marlborough's Victories.

The period 1702 to 1713 is memorable in military annals for the famous victories with which the name of Marlborough is associated. "The four great victories of Blenheim, Ramillies, Oudenarde, and Malplaquet," says Captain O. Wheeler in *The Story of Our Army*, "render the period from the accession of Queen Anne in 1702 to the Peace of Utrecht one of extraordinary military brilliance."

As Alison says, it was the Battle of Blenheim (1704) that "at once destroyed the vast fabric of power which it had taken Louis XIV. . . . so long to construct." Creasy writes that but for the victory of Blenheim—the greatest of the four great victories—"all Europe might at this day suffer under the effect of French conquests resembling those of Alexander in extent, and those of the Romans in durability." The results

of Marlborough's victories were twofold: (1) the military ascendency of the allied armies was established, and (2) the power of Louis XIV. was as completely crushed as the power of Philip II. had been at the defeat of the Spanish Armada in 1588.

VI. The Army's Achievements in the Nineteenth Century.

From the signing of the Treaty of Utrecht (1713) till the outbreak of the Peninsular War (1808) there is little to record. At the beginning of the nineteenth century Napoleon's star was in the ascendant, and he was undoubtedly one of the greatest generals the world has ever seen. His illimitable ambition led him on from conquest to conquest. Germany, Prussia, Austria, and the Netherlands fell into his hands. Russia was invaded, and preparations were made for the invasion of England. Nelson's signal successes in the Mediterranean and in the Atlantic frustrated Napoleon's schemes, and Wellington's success at Vittoria rescued Spain from French domination. In 1814 Napoleon abdicated and retired to Elba, from whence he escaped in 1815.

At Waterloo the rival generals—Wellington and Napoleon—met, and it was here that Napoleon was defeated. To quote the words of Lamartine, "This defeat left nothing undecided in future events, for victory had given judgment. The war began and ended in a single battle." The overthrow was complete.

Between the Battle of Waterloo and the outbreak of the Crimean War (1854–55), there was a period of military inactivity. During the Crimean War there was much privation, mismanagement, and lack of organisation, which roused in England a storm of public indignation. The most notable events were the battles of Alma, Inkerman, and Balaclava, the siege of Sebastopol, and the attacks on the Malakoff and the Redan.

The events which have occurred in recent years, *e.g.* the reconquest of the Sudan, the South African War, etc., are too well known to be further considered here.

THE BOARD OF EDUCATION AND REGISTRATION.

The following letter has been sent by the Board of Education to the Registrar of the Teachers' Registration Council:—

May 3rd, 1906.

Sir,—In reply to your letter of the 23rd ultimo, I am to inform you that, in view of the provision contained in Section 36 of the Education Bill now before Parliament, the Board have decided to continue the recognition of Schools and Institutions now recognised by them for purposes of the Registration Regulations, without further inquiry in ordinary cases, until December 31st next. Applications for recognition from Schools and Institutions not previously recognised for purposes of the Regulations will for the present be considered by the Board on the same terms as before, but recognition where accorded will be until December 31st, 1906, only.

Recognition accorded in the past, or in the next eight months, for the purposes of Sections 3 and 4 of the Regulations will cease upon the discontinuance of the Register.

I am to add that the Board are contemplating the establishment and periodical publication of a list of Secondary Schools in England and Wales (using that term in the sense set out in the definition prefixed to their Secondary School Regulations) which may be hereafter recognised on application, after full inspection, as reaching the standard of efficiency required in the case of Schools recognised for Grant under those Regulations, though they may for other reasons be disqualified for Grants from the Board.—I am, Sir, your obedient Servant,

Robert L. Morant.

REGULATIONS FOR SECONDARY SCHOOLS.

GEOGRAPHY—(*continued from page* 531).

Mexico.—Area, 751,000 square miles. A vast tableland between United States and Central America. In the south are volcanic ridges. Note Jorullo, Orizaba, and Popocatepetl. Much of the interior is about from 6000 to 8000 feet above sea-level. The country does not possess a good navigable river. The elevated regions enjoy a mild and pleasant climate; the coast regions are hot and unhealthy.

Industries.—Varying temperatures render it possible to cultivate the productions of tropical and temperate regions, but agricultural methods are backward. Orange, banana, pine-apple, cacao, coffee, vanilla, and sugar-cane are produced with ease. Maize is a general crop, and large quantities of tobacco are grown. The area under cotton is extending, but insufficient to supply the hundred Mexican cotton mills. Coffee-planting has attracted American capital, and consequently is thriving. Cattle-rearing important; 20,000 cattle ranches. Mining (especially silver, gold, lead, and iron) is important.

Communications.—No railway until 1873. Now over 10,000 miles of line open. From the Central Pacific Railway in the United States there are two lines to the capital. Note particularly the Tehuantepec Railway, 192 miles in length, across the isthmus from Salina Cruz to Coazacoalcos; important link in the trade of the western coast of America with the Gulf and the Mississippi; also between United States and Eastern Asia (*e.g.* Japanese steamers run to Salina Cruz for raw cotton from the United States for Japanese mills). The extension of the Mexican line to the Guatemalan frontier will be another link in the great Pan-American railway that is to bring North and South America into closer touch with each other.

Trade and Commerce.—British trade with Mexico. In 1904 we took £595,000 from Mexico, sending her £2,075,000 in return, half of which consisted of textiles. Half a century ago Great Britain absorbed quite half the trade of the country; her share is now about 17 per cent. The facility of communication alone accounts for the United States now taking 51 per cent. of the Mexican trade.

Note the chief towns, especially those with commercial possibilities, the people, and government.

Historical.—The land of the Aztecs and King Montezuma. The Spanish conquest under Cortez. Three centuries of Spanish oppression. Republic declared in 1822. Troubles with European Powers. Maximilian set up by Louis Napoleon in 1867. Maximilian captured and shot by Republicans. Law and order have replaced the old turbulence and unrest.

Central America.—The name given to the territories between the isthmuses of Panama and Tehuantepec. The States are:—Guatemala, Honduras, Salvador, Nicaragua, Costa Rica. The total area is about three times that of England and Wales. The physical features resemble those of Mexico—high plateaux and low coast plains. Among the mountains are several active volcanoes. Earthquakes frequent and destructive. The rivers and lakes are unimportant, except the river San Juan and lakes Nicaragua and Managua,

as a prospective commercial highway across the isthmus.

Discuss each State separately as regards productions, people, and chief towns. The general unrest and frequent revolutions militate against commercial progress; capitalists are chary of investing money where government is liable to violent upheavals.

British Honduras or Belize.—Crown colony. Capable of yielding every tropical product. The vast forest wealth—mahogany, cedar, logwood, ironwood, pine, and india-rubber trees; sarsaparilla. Timber cutting the chief industry. Sugar is grown and exported. Tropical fruits abundant.

Central American Canal Schemes.

1. *Nicaraguan Route.*—To connect Greytown on the Atlantic with Brito on the Pacific by means of the San Juan river—a total distance of 128 miles. The San Juan, though a tropical river, is not subject to floods, and a navigable channel could easily be dredged, off the south-eastern shore of the lake.

2. *Chiriqui-David Scheme.*—Chiriqui lagoon is an excellent natural harbour, and from thence to David, *via* the river of the same name, presents no great engineering obstacles. No available harbour on the Pacific Coast.

3. *Caledonian Bay Scheme.*—Suggested that canal pass from Caledonia to the Gulf of San Miguel by means of the Tugra river (*cf.* the Darien scheme and Scottish expedition under William Paterson in 1699).

4. *The Tehuantepec Scheme.*—This canal scheme dates back to the time of Cortez. Half a century ago engineers reported favourably on the route, a break in the mountains allowing of an easy junction with the Coazacoalas river.

5. *Panama Scheme.*—The foregoing are unimportant compared with the Panama Scheme commenced twenty years ago. Ferdinand de Lesseps and the failure of his scheme after the expenditure of £70,000,000. The United States, by arrangement with Colombia, is now completing the work. The estimated cost is £45,000,000, and the work is expected to be completed about 1916.

West Indies.—The double curve of islands from Florida to the mouth of the Orinoco, lying directly in the course of the Gulf Stream and of the north-east trade winds. The four natural groups: the Bahamas, the Greater Antilles, the Lesser Antilles or Windward Islands, the Leeward Islands. Note name "West Indies," in token of error of Columbus that when he reached the Bahamas he had sailed round the world to India. Practically all the islands of the Greater Antilles are mountainous, with ranges running east to west. The heights of the Lesser Antilles are chiefly volcanic peaks. The Bahamas are a low coral group. All the islands possess low coastal plains.

Climate and Productions.—Note the essentially tropical climate. The effect of daily sea breezes, the trade winds, and the elevations. The wet and dry seasons. Hurricanes.

Extreme fertility of soil except in the Bahamas. Vegetation luxuriant. All tropical plants succeed. Sugar, once the great staple, injured by unscientific methods of cultivation, laziness of freed negroes, and competition of beet sugar. Cuba still produces twice as much cane sugar as any other country in the world. Jamaica, Trinidad, and Barbados yield large quantities. Tobacco important, especially in Cuba. The famous cigar leaf of the Vuelta-abajo district. Havana cigars; many of them, though manufactured in the island, are not composed of Cuban leaf. Coffee of rising importance, especially in Jamaica. The cacao of Trinidad and Grenada ranks next to that of Venezuela.

Fruits, spices, drugs, and dyes. Note recent development of fruit trade, notably oranges and bananas of Jamaica; special fruit steamers now running to Bristol. The lime particularly successful in Montserrat and Dominica. Note the banana is "the bread and potatoes of the tropics." Forest products. The mahogany of Haiti the best in the world.

Briefly discuss each island: the people and their occupations. Note British possessions particularly. Haiti, where "Black rules White." The mixed races.

Historical, etc.—The Spanish Main. The buccaneers of the seventeenth century. The slave trade. Oliver Cromwell's attempt to break the pride of Spain. Capture of Jamaica. In 1782 France and Spain planned to recapture it from England. Rodney and Hood's victory off Dominica. Emancipation of slaves in British dominions in 1834. £6,000,000 paid in Jamaica alone to free 300,000 blacks. Revolt of the freed slaves in 1865. Modern problems.

South America.—All the countries of South America, with the exception of the Guianas, are republics modelled upon the constitution of the United States. Several of them have had very chequered careers, and even now revolutions are a common experience. Brazil, Argentina, and Chile are the chief countries; more settled in Government than their neighbours, their political and commercial progress is more marked.

Brazil.—Area nearly equal to the whole of Europe. One half the area consists of a huge plateau exceedingly well watered. Vast areas of dense forests. The Amazon from source to mouth has a length of 3000 miles. Where the Madeira falls into the main stream it is three miles wide. It afterwards narrows again considerably. Again it widens, and attains depth of 200 feet. Enters sea by mouth 180 miles wide.

Climate and Productions.—Although only extreme south of the country lies outside the tropics, the heat is less oppressive than in corresponding latitudes. Coastlands tempered by the sea; interior modified by the innumerable waterways and vast forests, and over all the beneficent trade winds. Nature's prodigal favours. Scarcely a plant of economic value that cannot be grown in some portion of the country—coffee, sugar, cacao, maize, rice, wheat, tobacco, cotton, tea, and coco-nut. Mahogany and other cabinet woods abound; dyewoods and rubber are general. The domestic animals of Europe thrive. The great mineral wealth. Agriculture the chief occupation. Annual output of coffee exceeds twelve million bags. Sugar-cane, especially in Pernambuco district. Para, the great rubber market. Cotton is an important export. Mining suffers for lack of good fuel. One hundred and fifty cotton mills in Brazil.

Communications, Trade, etc.—Railways chiefly in connection with the eastern ports, extending but short distances inland. Value of the imports and exports. Britain's share of the trade.

People.—Population fourteen millions; only one-third whites, two million negroes, one and a quarter million Indians, and the remainder mulattoes and

mixed breeds. Europeans chiefly in coast towns. Slavery rampant until 1871; finally abolished in 1888. Astonishing progress in recent years.

Historical.—Portuguese took possession of Brazil in April 1500. First used it as a convict settlement. Large number of Portuguese Jews banished to Brazil half a century later. The new settlers commenced sugar-planting. By beginning of the seventeenth century Brazil was so flourishing that other nations viewed with envy the claims of Portugal. In 1624 the Dutch took possession of the country, and in turn gave way to the Spaniards a few years later. In 1637 the Dutch again commenced conquest of the country, and after peace was declared the Brazils were ruled jointly by the Dutch and Portuguese. Eventually Holland conceded all her claims for a monetary consideration.

Gold was discovered in 1698, and diamonds thirty years later. By the year 1800 about 2000 cwt. of gold and 2000 lbs. of diamonds were despatched to Portugal. In 1808 King John of Portugal and his court fled to Brazil when the French invaded Portugal. In 1822 Brazil declared entire separation from Portugal, and elected Pedro, a Portuguese prince, emperor. In 1889 the Emperor and his family were exiled and a republic declared.

Argentina. — Area. Coast. Physical features, especially rivers. Country divided into four climatic regions with varying products:—(1) The Chaco, in the north, well watered and fertile, yields maize, coffee, sugar, and tobacco. Yerba maté tea is important. (2) Pampa grass lands. The temperature, abundant grass, good water supply, cheap labour, and nearness to Europe, give the region an immense advantage over Australia in the production of wool and mutton. (3) Slopes of the Andes marked by varying climates; vine in particular flourishes on southern slopes; maize and wheat and other cereals. (4) Patagonia, on the whole cold, but modified by proximity to the Atlantic. Great tracts absolutely sterile. Increasing area of pampa lands coming under cultivation, especially wheat.

Productions and Industries.—Varied vegetable products. Argentina one of the world's granaries. Immense flocks and herds. Ranches or *estancias*. With about half the area and same population as Australia, country possesses nearly three times as many cattle and as many sheep as Australia. Third in world in cattle, second in sheep. Great chilled meat trade.

Communications and Commerce.—Eastern and central parts so flat that railways need not an embankment a yard high or a cutting a yard deep; consequent ease of railway development. Rivers usually extremely navigable for same reason. Analyse chief exports and their destination. Germany gaining much of the trade at the expense of Britain.

Miscellaneous.—Greater proportion of the people are of white race than usually the case in South American republics. Those of Spanish descent predominate, but of the new-comers fifty per cent. are Italians. Population. The Gauchos. Spain did not acknowledge her independence until 1842. Civil wars have retarded progress. War with Paraguay in 1865–70. Future prospects of Argentina second to none among the South American States.

Chile.—The long strip of territory; 2500 miles long, varying width from 40 to 200 miles. Area. Andes rise to 23,000 feet in Aconcagua. Owing to great extension from north to south the climate varies greatly. Hot and rainless in the north; temperate and well suited to agriculture in the centre; Patagonian region densely forested.

Productions and Industries.—Wheat, maize, barley, vine, coffee, tobacco, hemp, and flax cultivated successfully. Mineral wealth. The nitrate industry. Copper output fifth in world. Punta Arenas coal mines. Guano.

Miscellaneous.—The first State to possess a railway, but the build of country does not favour railway engineering. The nitrate railway. Valparaiso connected with Buenos Ayres, three and a half days' journey. From June to October for 150 miles over the Andes the line is blocked by snow. Chief ports; their average distance from western Europe. Probable effect of Panama Canal on Chilian trade. People and government. Chile under Spanish yoke until 1810. War with Bolivia and Peru in 1879–83; Peru routed and forced to cede Tarapaca; Bolivia forfeited her coast line to Chile. Rebellion 1891. Credit of Chile now ranks higher than other South American States.

Paraguay and Uruguay.—Boundaries and area of each, neither of which possess marked physical features except rivers. Paraguay, entirely inland state; Uruguay, sea and river boundaries, but no good harbour. The climate is even, but Paraguay the more tropical. In Uruguay, cattle-rearing is chief industry. Fray Bentos (Liebig's Meat Extract Factory). Varied products of Paraguay; forests in the north; sugar, tobacco, and manioc, in the south. Tapioca the staple food; men, women, and children smoke cigars. Trade and commerce. Disastrous effect of war of 1865–70, when Paraguay was opposed to Brazil, Argentina, and Uruguay. Her population decreased from 1½ millions to less than 225,000, of whom only 30,000 were males over 15 years of age.

Venezuela.—Area. Coast. Orinoco plain. Maracaibo basin. Highland regions. Three distinct zones, agricultural, pastoral, and forest. Chief products. There are 30,000 coffee estates, 11,000 sugar, and 5000 cocoa. Coffee important export. Caraccas cocoa finest in the world. Forests yield valuable timber, balsams, and vanilla. Mineral wealth. No industries; even sacks in which to pack exports are obtained from abroad.

Communications.—No roads except in neighbourhood of chief towns. Trade of the interior carried on by means of pack-animals and small mule-carts. Caraccas connected with La Guayra by rail; 26 miles of line necessary to traverse the 6 miles that separate the cities. Within this distance, the line ascends 5000 feet, and then descends 11,000 feet.

Miscellaneous.—Houses, of Caraccas especially, possess thick *adobe* walls to resist frequent earthquakes. Conquest of country by Spaniards marked by horrible atrocities. Simon Bolivar organised a federation of States to free themselves from Spanish rule. Between 1830 and 1870 the country suffered continual revolutions and civil wars. For many years the boundary between Venezuela and British Guiana was the subject of disputes. Within the last few years the Venezuelans have been embroiled with Britain and with Germany.

The Guianas.—Physical features of all three divisions present the same features: (1) Fertile coast plain, in some parts below sea-level, necessitating dams and dykes; (2) a strip of savannah; and (3) mountain plateaux densely forested. The British, French, and

Dutch boundaries are well defined, but their boundaries with Venezuela and Brazil have been disputed. In the case of Venezuela the discovery of gold in Cuyuni basin gave rise to the contentions.

British Guiana.—Area. Rivers. The latitude and low level would give intensely hot climate but for the constant sea breezes and the heavy rainfall. Temperature of the coast-lands ranges between 74° and 90°. Two wet seasons, December to February and June to August. Sugar, the staple product. Hindoo coolies and Chinese work on the plantations. Chief exports: sugar, rum, timber, and gold. The Dutch were the first successful colonisers from about 1613. In 1666 England seized both the Dutch and French territories, but restored them. Abolition of slavery and beet-sugar adversely affected the product of Guiana.

Dutch Guiana resembles its British neighbour in nearly every respect except that coffee and cacao receive more attention than sugar.

French Guiana.—Smaller area. Climate vile. Red pepper, known as Cayenne, is grown in the neighbourhood of St. Louis, the only town. On the Ile de Diable is a penal settlement with a particularly evil reputation.

Colombia.—Unfortunate in touching five other States and having boundaries badly defined; constant disputes. Four zones of climate with varying products correspond to the main physical features:—(1) The tropical climate of the low plain and river valleys; sugar, cacao. (2) Sub-tropical climate of the foothills and upper valleys; coffee and maize. (3) Temperate climate of the high plateaux; tobacco, wheat, fruit. (4) The cold mountainous regions.

Industries and Commerce.—Agriculture and cattle-rearing are chief occupations. Mining for precious metals. No manufactures except Panama hats. Isthmus of Panama, with its valuable transit trade, is the most important part of the country notwithstanding its bad climate. Describe Panama Railway and discuss enormous possibilities of the Panama Canal.

Miscellaneous.—One of the most restless of the South American States. Only a fifth of the population are pure whites; Indian half-breeds form half the total. Slavery not abolished until 1852. Colombia played a leading part in Bolivar's struggle against the Spaniards.

Ecuador.—A wedge between Colombia and Peru. Seaboard. Land boundaries badly defined. Three main areas:—(1) Lowlands west of the Andes; (2) plateaux of the interior; and (3) a stretch of forested country to the east. The mountains are largely volcanic; Cotopaxi and Sangai are constantly active. Mount Chimborazo (20,610 feet). In the eastern region are some of the head-waters of the Amazon.

Climate and Productions.—Plains of the coast are moist and heated, producing cocoa, coffee, cotton, yams, tobacco, etc. The mountain region is cool and delightful, especially the plain of Quito. Minerals are abundant, but little worked. Cocoa is the chief export, almost equalling in value the exports of rubber, hides, coffee, metals, and cattle that are exported. Roads are practically non-existent. Goods are often in transit five months between the coast and Quito, but a railway is now approaching completion.

Miscellaneous.—Ecuador formed part of Bolivar's confederation. It has passed through more turmoils than other States, and even now its finances are sadly, if not hopelessly, embarrassed.

Peru.—Area. (1) The arid coastal plain. (2) The Andean regions, cold and barren; the Pasco table-land. (3) The Montana, the plain of the interior, containing upper portions of the Amazon.

Climate and Productions.—Coast regions are hot, with rain almost unknown; dependent for moisture upon dense mists. Abundant rains on the eastern plains. Frequent earthquakes. Agricultural resources are great, but mineral wealth still more important. All the rich products of South American forests are available in the Montana. Where the coast districts are watered, most tropical products are raised. The great need is irrigation. European food plants in the higher regions. The gold, silver, and quicksilver mines were once the richest in the world; now decreasingly worked. Guano from the Chincha Islands; nitre and petroleum.

Communications.—Considering the physical conditions the communications are good. Amazon and its tributaries serve the Montana. Lake Titicaca, half the size of Lake Superior, provides navigation for the plateau. There are short railways from Mollendo and Lima inland; in the latter case the Andes are crossed near Oroya at a height of 15,645 feet.

Miscellaneous.—Imports and exports. Chief towns. The original inhabitants, the Inca Indians, were highly civilised before advent of the Spaniards. When slavery was abolished in 1855 Chinese coolies were imported; 60,000 arrived between 1860 and 1872. The struggle for independence. Disastrous war with Chile, 1879–1883.

Bolivia.—Area. Coast lost to Chile when assisting Peru in 1879. Country contains some of the highest portions of the Andes; Sorata (24,812 feet), the highest peak of the New World. Vast eastern plain drained by the Amazon and Paraguay.

Climate and Productions.—Situated entirely within the tropics, the varying elevation affords a wide range of climate and productions. Low plains yield coffee, rice, cacao, cotton, and tobacco, cinchona, rubber, etc. Wheat and maize thrive in the temperate climate of the valleys of the eastern terraces. Rich tropical forests. Mining is the most important industry, especially gold, silver, copper, and tin. Potosi silver mines alone have yielded £650,000,000 sterling of silver.

Miscellaneous.—Landlocked position not conducive to foreign trade. Railway communication from Oruro to the Chilian port, Antofagasta, and from La Paz *via* Lake Titicaca to Mollendo in Peru. Communication with Argentina presents better trading possibilities. Silver forms two-thirds of the exports.

Bolivia takes its name after Bolivar, the great liberator. Purposeless and useless revolutions and disastrous wars, especially the one with Chile, have hindered progress.

Ambleside Summer Course.—We are sure that our readers will be pleased to know that the Committee has practically completed the arrangements for another course on the same lines as in previous years. It will certainly afford opportunities for passing the holiday profitably and pleasantly.

Not the least valuable is the opportunity afforded for obtaining an enlarged outlook and interchange of ideas and methods; this, by virtue of the intercourse of students and others drawn from Centres scattered over Great Britain.

The whole of the work throughout the Course is conducted upon distinctly educational lines, both in theory and practice. The appreciation of the true relationship and connection between Drawing, Manual Work, and other subjects of the school curriculum and their developing influence as factors in education, in contradistinction to the acquisition of craftmanship, is recognised throughout.

Our Modern Language Section

FRENCH PRIZE COMPETITION.

RULES.

1. All translations should be **posted not later than June 8th, 1906**, and addressed:—PRIZE EDITOR, Office of the *Practical Teacher*, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.
3. Competitors should write pseudonym only on MS. Prize-winner will be asked to send name and address for publication.
4. No competitor may take the prize offered more than once in three months.

A Prize of Half a Guinea is offered for the best rendering into English of the following extract:—

"Vers le milieu d'une de ces nuits, où la lune éclairait sa chambre, elle (Marie Antoinette) la contempla, et me dit que dans un mois elle ne verrait pas cette lune sans être dégagée de ses chaînes, et sans voir le roi libre. Alors elle me confia que tout marchait à la fois pour les délivrer; mais que les opinions de leurs conseillers intimes étaient partagées à un point alarmant, que les uns garantissaient le succès le plus complet, tandis que les autres leur faisaient entrevoir des dangers insurmontables. Elle ajouta qu'elle avait l'itinéraire de la marche des princes et du roi de Prusse; que tel jour ils seraient à Verdun, tel autre dans un autre endroit; que le siège de Lille allait se faire; mais que M. de J. . . . dont le roi ainsi qu'elle estimaient la sagesse et les lumières, les alarmait beaucoup sur le succès de ce siège, et leur faisaient craindre, quand même le commandant leur serait dévoué, que l'autorité civile, qui par la constitution donnait une grande force aux maires des villes, ne l'emportât sur le commandant militaire. Elle était aussi très inquiète de ce qui se passerait à Paris pendant cet intervalle, et me parla, du peu d'énergie du roi, mais toujours dans des termes qui peignaient sa vénération pour ses vertus et son attachement pour lui. 'Le roi, disait-elle, n'est pas poltron; il a un très grand courage passif, mais il est écrasé par une mauvaise honte, une méfiance de lui-même, qui vient de son éducation autant que de son caractère! Il a peur du commandement, et craint plus que toute autre chose de parler aux hommes réunis. Il a vécu enfant et toujours inquiet sous les yeux de Louis XV. jusqu'à vingt et un ans; cette contrainte a influé sur sa timidité. Dans la circonstance où nous sommes, quelques paroles bien articulées, adressées aux Parisiens qui lui sont dévoués centupleraient les forces de notre parti: il ne les dira pas. Que pouvons nous attendre de ces adresses au peuple qu'on lui a conseillé de faire afficher? Rien que de nouveaux outrages. Pour moi, je pourrais bien agir et monter à cheval, s'il le fallait: mais si j'agissais, ce serait donner des armes aux ennemis du roi: le cri contre l'Autrichienne, contre la domination d'une femme, serait général en France; et d'ailleurs j'anéantirais le roi en me montrant. Une reine qui n'est pas régente doit dans ces circonstances rester dans l'inaction et se préparer à mourir.'"

From the "Mémoires de Madame Campan."

RESULT OF THE MAY COMPETITION.

The prize is awarded to "Thirlestane." (Will "Thirlestane" kindly forward name and address for publication?)

First Class.—Eicarg, Arion, C. E. M., Duclair, Dunnottar, Dewhurst, Winnowsty, Strawberry, Devanka, van Baërle, Try again, Mergy, Jan Dall, Aquina, Quis, Dimitri, Bobby, Raema, Nolle, Summerbank, Acharn, Hightae, Intonsus, L. B. G., Aldyth, Caudebec, Jupiter, Nil Desperandum, Satiya, Atalanta, Carpe diem, Comet, Débutante, White Rose, Namron, Monq, Shakspere, Denbes, Nehemiah, Hélène, Espagnol, Max, Danella, Sea-anemone, Agaznog, Bella, Bonaventure, Kajeane, Stonefield, Zelda, Zaïre, Cherub, Missette, Portia, Voltaire, Whippersnapper, Ronnoc, Dead Heat, Chaos, Charicleides, Troisième, Alf, Bluebell, Polyglot, Musumé, Alter ego, Lenias, Guy, W. W. B., Noiram.

Second Class.—A. M. O., Affo-dyle, La jeune fille, Ava Maru, A2, Cinerea, Boaz, Cinquième, Dim, Puer, Caerfryddin, Vivienne, Hydrangea, Dindon, Octavia, M. A. G., Joubert, Andeer, Adolphus, Jeannette, Figaro, Biwas, Marais, Rita, Daffodil.

The name and address of "Sarum," the winner of last month's competition, are:—Miss Harriet Wragg, 136 Castle Street, Salisbury.

Report.

Considering the abstract nature of the exercise set, the success with which candidates, as a general rule, grappled with it is wonderful. Had such a piece been given some years ago, a much smaller proportion of candidates would, I am confident, have been placed in the First Class. A good many candidates translated *métaphysiques* as "metaphysics," and not as an adjective referring to *faits*. Some did not realise that *tout* in *tout principe*, etc., means "every," and that *sujet* is in apposition with *esprit humain*. One candidate translated *commodes par leur concision et leur énergie* as "chests of drawers for their brevity and energy."

Prize Translation.

To our mind philosophy is the science of human nature, as studied through the facts which she offers to our observation. Among these facts there are some which appeal more particularly to the mind, and which for that reason are commonly called metaphysical. Metaphysical facts, the phenomena in which human intelligence manifests itself, reduced to general formulæ, constitute intellectual principles. These principles may be considered from two points of view; either in relation to the mind in which they exist, to the individual who possesses them, to the consciousness brought to bear on them; or in relation to their objects—that is to say, considered not in themselves, nor as existing in us, but in their practice and their results. Let us consider the matter; all intellectual principles are connected with the human mind, and while relating to that human mind, the centre of all consciousness and all knowledge, they affect objects independent of the mind which conceives them; or, to use well-known terms, convenient by reason of their conciseness and expressiveness, every intellectual principle is either subjective or objective, or both at once. There is no principle, no knowledge, no idea, no perception, no sensation, but is capable of this general classification, which puts all philosophical problems in the first place into two great divisions—problems relating to their subjects and those relating to their objects.

THIRLESTANE.

OUR TUTORIAL SECTION

NEW SCHOLARSHIP COURSE FOR 1906-7.

BY ARTHUR T. FLUX,

Late Principal of the Belvedere Pupil Teacher Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

Work for the Month.

PART I.

1. *Reading.*—Ten minutes' oral practice each day with as much silent reading as time will permit. This exercise must be performed most regularly, since it is only by steady and persistent effort that ease, fluency, and a quick appreciation of the meaning is obtained.

2. *Recitation.*—Learn the next twenty lines. The same remarks apply to this as to reading; *oral* exercise is particularly needed.

3. *Penmanship.*—Write a page in the *Practical Teacher Copy Book* daily, and use great care at all times. "Defective handwriting will be taken into account," can only mean that marks will be deducted for poor writing. Writing is the easiest of all subjects to improve if persistent care is bestowed upon it.

4. *Composition.*—Write one or two essays each week on such subjects as the following. Read up the subject if necessary—you cannot work without ideas and facts; make out a skeleton plan, and then clothe it in your best language. Revise carefully, reading the essay aloud to ascertain if the sentences are well balanced. If these are too short, the style is abrupt and brusque; if too long, there is a tendency to confusion and dulness. An essay requires original thought. You may read as much as you like and conveniently can, but the essay must be your *own*, and must show that, although you are acquainted with other people's opinions, you do not merely quote them. Think clearly and accurately. Nothing is so fatal to any student's success as a mental haziness and wooliness, which shows a superficial knowledge of everything, but nothing clear and exact.

Take care with the opening of the essay. Do not commence with a commonplace and trite statement. Divide your essay into paragraphs according to the various aspects considered, and finish with a good peroration. General advice will not be so useful to you as individual criticism, and therefore you should send up at least one essay a month for criticism. I shall be pleased to give a small book prize for the best essay sent in on one of the subjects set below.

Subjects—

(*a*) Use of pictures in teaching.
(*b*) Colonisation.
(*c*) Fruit-trees.
(*d*) Words are like leaves, and where they most abound
Much sense of fruit beneath is rarely found.
(*e*) Effects of the feudal system.
(*f*) The darkest day, wait till to-morrow
Will have passed away.
(*g*) Benefits to be derived from nature study.
(*h*) Our food-supply.

Notes.—(*a*) Teaching is, looked at from one point of view, the process of transference of ideas from the teacher to the taught, and the most successful teacher is the one who understands most clearly how ideas must be best transferred. "Telling" is not teaching in the majority of cases. With children, your knowledge of psychology should tell you, the strongest faculties are sensation and perception; imagination is untrained and undeveloped. Suppose, then, you are giving a lesson on, say, a Norman castle, mere description is comparatively useless, since, although it may be graphic and detailed, you are appealing to what does not exist in the minds of the listeners. But a good picture will convey a clearer impression than you are able to make, and in a shorter time, because the sensation of sight is strong.

Much of course depends upon how a picture is used. It may be placed before a class and teach nothing. The attention must be drawn to the points to be remembered—the size, the position, the material, the internal arrangements, the provisions for defence, the use of each particular part. Under the skilful direction of the teacher the picture tells a tale which is easily understood by all.

Apart from such direct lessons, good pictures provide a valuable æsthetic training in colour, proportion, and beauty, but only when the salient points are noted. One of the commonest forms of newspaper jokes arises from the total misunderstanding of the meaning of a picture. The American (let us hope it was an American and not an Englishman) who thought Millet's "Angelus" was a picture of peasants "burying the baby," or the lady who possessed a picture of "Jupiter and Io," which she called Jupiter and TEN, gained little from their observation; and there are many people who fail to see much difference between a masterpiece of Constable and a coloured plate given away with the Christmas number of a magazine.

(*b*) The founding of a colony may be caused by many circumstances. In some cases—*e.g.* the old Phœnician and Greek colonies—they may be merely trading-stations; in others—*e.g.* Australia—they were originally convict stations; in others, again, they are merely calling stations for ships; and again, they may be the new homes made by children from the mother-country, who are driven abroad by competition and distress at home, or by religious persecution. Instances may be given of each.

The class of persons required to make successful colonists may then be discussed. A man who can do nothing for himself at home will not do much more abroad, but the hard worker—manual, rather than mental—usually finds a better scope for his energies in a less densely populated country.

The *results* of colonisation may be considered—increase of trade and commerce, an improvement in physique, and in mental calibre.

(*c*) There is something very fascinating in the study of the economy of nature; she is not a goddess who bestows gifts indiscriminately and lavishly, neither is she parsimonious and stingy. "Give me your work," she says to mankind, "and I will amply repay you; be lazy, and you get nothing." This is clearly observed in all the various plants which supply us with food, and in no case so obviously as with fruit-trees. Leaving out of consideration the tropical fruits, which are bestowed with a profusion warranted only by the enervating conditions of temperature and climate, all our fruits are the product of centuries of care and development. One need only compare the strawberry as cultivated with the wild fruit from which it has been developed, the apple with the sour crab, the plum with the sloe, to see that, although nature gave a basis to work on, the development has been left to man. Continual care, draining, transplanting, vigorous pruning, and crossing species, have been necessary. Left to themselves, trees and plants soon begin to relapse into their primitive condition.

(*d*) "Speech is silvern; silence is golden," "An empty pitcher makes most noise," and many other household phrases, teach the lesson that the consensus of opinion is against saying too much. Great men have rarely been great talkers; the very greatest are often the most taciturn. The reasons are fairly obvious. A man who thinks carefully and deeply has not the time for empty chatter, nor the inclination. He reads, listens, and thinks, and is slow at coming to any conclusion, whereas the street-corner politician, who knows nothing, can usually convey it to others in multitudinous words.

There is a danger, of course, of the habit of self-restraint being carried to such an excess that it becomes a defect; but this occurs comparatively rarely.

(*e*) These can readily be traced from your study of the period in history.

(*f*) The greatest blessing to the human race is the divine gift of being able to look forward with hope. To the weary toiler, to the tired student, to the harassed business man, to the sick

person, to those in grief and distress, the thought of a better and happier future is the one thing which sustains their courage and alleviates their distress. Without this gift it would be difficult for any one to pass through the various crises which come in every life; suicide would become the usual effect of any disappointment. It is not to be wondered at that the old philosophers pictured hope as a specially heaven-sent gift.

(*g*) A very common piece in reading-books of some twenty years ago was a tale called "Eyes and No Eyes," wherein two boys take a walk; the one comes back disgusted because he has seen nothing, the other delighted that he has seen so much. The moral is obvious. The boys represent the two great classes into which people may be divided—the observant and the non-observant. It was with the idea of training the observation, or directing the attention of children to the wonders and beauties of nature, that the subject was introduced into the school curriculum. So far, it has been to a great extent a failure; books on nature-study are earnestly read and crammed, and nature is left severely alone. It is unnecessary to enlarge upon what may be seen in nature—there is nothing from the tiniest insect to the loftiest mountain which is not brimful of interest; but the habit of observation — careful and intent, and not cursory and superficial—is one which should be most carefully developed, as such a habit is a valuable asset in all works of life. The instance—mythical or true—of Newton and the apple is a case in point.

(*h*) Very little assistance is needed with this subject. Show first that England has changed during the last 150 years from an agricultural to a manufacturing country, which does not produce sufficient food for its population. Hence the necessity for importation of food-stuffs. Secondly, take the articles which, though food, are not essentials, and show whence they are procured. The wealth of England enables the poorest to draw upon the world's supply.

5. *Arithmetic.*—G.C.M. and L.C.M. Study the theory of these rules carefully to understand *why* the rule produces the required answer. Be prepared to find both G.C.M. and L.C.M. by factors. Examine carefully the meaning of "If a measures b and c, it measures $nb \pm mc$," or, expressed in words, "If one number is a measure of two others, it is also a measure of the sum or difference of any multiples of either." This may be proved generally, thus—

If a measure b, let $b = pa$.
If a measure c, let $c = qa$.

Then substitute these values in the expression $nb \pm mc$, and you get

$$npa \pm mqa = a(np \pm mq).$$

$\therefore$ a is a measure.

Work as many of the exercises given in Christian and Collar as you can, especially the general examples on the rules. If any difficulty is found, write for assistance.

Work the following questions on the four simple rules:—

(1) Explain how to prove multiplication and division by casting out nines.

(2) The sum of two numbers is 4307 and the larger one exceeds the smaller by 147. How much less is the larger than 3050? Ans. 773.

(3) Divide 11767 by 504, using the factors 9, 8, and 7, and explain, as to a class of children, the value of each remainder. Take the factors in the order given.

(4) In demonstrating the subtraction of 3948 from 6075 a teacher borrows 10 from the 7 and pays back 1 to the 4. In what way is this demonstration unsatisfactory?

(5) Multiply 43002073252 by 133112111 in 3 lines.
Ans. 5724096747950354972.

(6) What must 2520 be multiplied by to make a perfect square? Ans. 35.

(7) Find by factors the cube root of 32461759. Ans. 319.

(8) What is the difference between the product of 18, 19, and 35 and that of 24, 17, 19? Use the shortest way of obtaining the result. Ans. 4218.

(9) Give the reasons for the process of long division.

(10) Find the least number which, added to 5760, will make the sum exactly divisible by 101. Ans. 98.

(11) In a game of cricket A, B, and C score 197 runs. A and C together score 120, B and C together score 90 runs. Find the score of each. Ans. 107, 77, 13.

(12) How could you tell before working the division 3308850 by 342 that, if there were no remainder, the quotient would be divisible by 25?

(13) Keeping the order of the factors and working in the usual way, multiply 987 by 3008, and 987 by 6992. Also show

(i) That by adding the results together their accuracy is confirmed but not absolutely proved.

(ii) How, before multiplying, we can see that every line of the working will be a multiple of 3, that four lines will be a multiple of 9, and two lines multiples of 27.

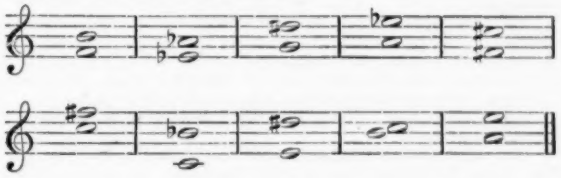
(14) How could you show with multiplying out that the product of 2345678 and 234567 is *not* 526830749626?

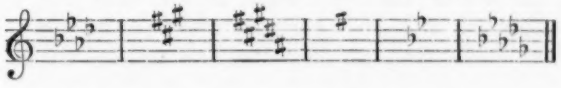
6. *Drawing.*—One or two freehand copies each week to fairly fill a half imperial sheet of paper—*i.e.* 22 in. by 15 in. Pay great attention to getting the proportions correct, the curves bold and smooth, and the lines soft and not "wiry."

Draw also one set of models. Each student should endeavour to understand, by the simple principles of perspective, what a vanishing point is. The models may be worked out with a ruler before being drawn freehand. Send up drawings for criticism and advice.

7. *Music*—Staff Notation. Easy transposition. The value of notes, dotted notes, and rests. Bars and time signatures.

Work the following questions:—

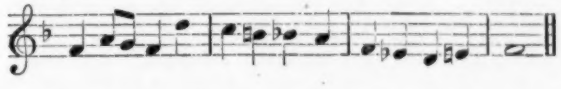
(1) Name the following intervals.

(2) What minor keys are shown by the following signatures?—



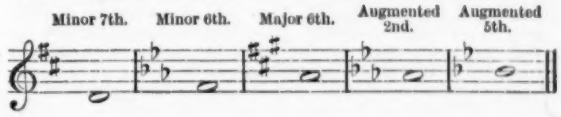
(3) Write the signatures of the following minor keys:—

F minor, B minor, E minor, G minor, B♭ minor, F♯ minor.

(4) Transpose the following into the key of G:—



(5) Write the following intervals above the notes given:—



PART II.

1. *English Grammar and Literature.*—The syllabus on this subject is simple and comprehensive: "(1) English Grammar. (2) The Elements of English Composition and Literature." A note at the commencement of the Regulations seems to imply that the standard in English will be rather higher than has been the case—a change which every one (candidates, perhaps, excepted) will welcome. The tendency during the last few years is to regard "English" as a knowledge, an appreciation of English literature, rather than an ability to analyse involved sentences and parse difficult words. "Questions will be set to test such knowledge as may be derived from books like Abbott and Seeley's *English Lessons for English People.* All candidates should have undertaken as wide a course as possible of general reading, which should include, amongst other books, one or two of Shakespeare's plays, some historical novels, and an anthology of verse."

This is altogether an advance on previous syllabuses. There are no special books to be read *ad nauseam*, or prepared by cramming up ready-made notes. Too frequently the student in days gone by was so engaged in looking for anachronisms, faults, peculiarities, etc., that the great meaning was altogether

missed. He could explain the most recondite allusion or reference made, but failed, and naturally so, to see any beauty in a work which to him was "dry." I was credibly informed a few years ago of a student who passed an examination with credit on one of Shakespeare's plays, who admitted that he had never read the text; his coach had given him carefully prepared notes, and those he had committed to memory. This is reducing the study of literature to an absurdity. It is well, therefore, that students should be tested on general reading. A very serious word of warning, however, must be given—this reading must not be taken lightly as a pastime. It will involve much time and thought if the progress is to be made which is evidently expected. As to how many books it is possible to read in a year, one cannot venture any opinion, but the minimum should be one per fortnight. Some students can easily double that amount. A list of suitable books will be given each month, with directions as to what to read for.

Grammar.—A knowledge of grammar is, of course, essential, but candidates should already have a very fair notion of the general rules, and revision and deepening will be required rather than new work. An exercise in parsing and analysis should be worked each week, as the ability to split up a sentence into its clauses or to point out the inflections and relations of any particular word is necessary to the proper appreciation of any passage.

For this month take the grammar of the noun, and revise number and the methods of forming the plural; gender, and methods of forming the feminine; case, and its inflections; and the various forms of nominative and objective cases. Wherever possible, look up the derivation which accounts for inflections.

Abbott and Seeley. Learn carefully Chapter I., and work the exercises given.

General Reading.—For this month read *Julius Cæsar*, *Hereward the Wake* (Kingsley), and *Harold* (Lytton). In dealing with Shakespeare's plays, it might be well to read through the paraphrase in Lamb's *Tales from Shakespeare* before taking the text, to which *two* months will be allotted. Read a life of Cæsar, and endeavour to get an idea of his times. Since the downfall of the Roman kings the State had been governed by two consuls elected annually, but for a century before the time of the play, political parties in Rome had been using swords as argument, and as one party secured the ascendency they endeavoured, in Eastern fashion, to secure their position by a massacre of their opponents. On the death of Sulla a Triumvirate was formed of Cæsar, Pompey, and Crassus, who divided the power between them. On the death of Crassus it was inevitable that Cæsar and Pompey should quarrel for the supremacy. Cæsar, who had conquered Gaul and crossed to Britain, had made his army not only a first-class fighting machine, but also strongly devoted to himself. He led his legions into Italy, and eventually conquered his opponent. It was but natural that he himself should be plotted against, and the play deals with his assassination and subsequent events. The characters of Brutus, the high-minded philosopher and patriot, and Cassius, the clever and unscrupulous political agent, are beautifully drawn. The Nemesis which pursues the successful conspirators to their ruin and death is as skilfully delineated as in any of the Greek tragedies.

The historical novels deal with the period to be prepared this month in History—a plan we shall adopt throughout the year. In *Harold*, Lytton points out the state of affairs preceding the Conquest which led to the coming of the Normans, and indicates the weaknesses of the Anglo-Saxon methods which led to the subjugation of the country. It contains some very fine passages, notably the scene before the Witan, the death of the Welsh king, and the battle of Hastings.

"Hereward, the last of the English," gives, in an altogether different style, a picture of the same period—the futile attempt of the English to break through the fetters which were gradually closing in upon them. It was the old story of brains against brute strength, in which the former is bound to win. All English students, I think, regret that William *was* the conqueror; they rank themselves on the side of Harold or Hereward, and feel a personal regret that their heroes do not win. And yet England gained more than she lost—the higher civilisation which followed could hardly have been attained without the infusion of new blood and ideas. So India has gained from its conquest by England, as the Transvaal will ultimately do.

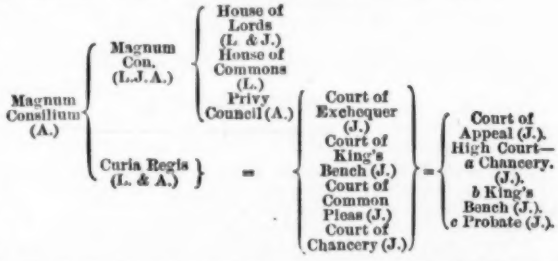
Verse.—The student cannot do better than obtain Palgrave's *Golden Treasury*, and read through the poems therein contained. Take the first twenty for this month.

In addition to the books which will be prescribed monthly, the candidate should possess a small library of books of reference. For example, a good derivative dictionary is an absolute essential; any new word must be looked out at once, and its exact meaning ascertained. Then a book such as Brewer's *Dictionary of Phrase and Fable*, is extremely useful for turning up references. Good English books all contain many references to the old classical and mythological beliefs, and the student would do wisely to read up a small book on Latin and Greek mythology, and also one on the Norse gods, such as *Heroes of Asgard*. A small dictionary of Biography is also of assistance.

2. *History.*—The syllabus comprises:—*A*. General history from 1017 to 1870. *B*. a special period, 1017–1399, 1399–1603, 1603–1714, 1714–1815, 1815–1870. Candidates may answer questions on *one* or more than one of these sections. *C*. The elements of the duties and rights of citizenship.

A. For this month prepare to the end of the Norman kings. The chief points to be mastered are: (*a*) The state of England which led to the invasion and conquest. (*b*) The changes produced by the Norman Conquest. (*c*) The Feudal System—its comparison with the Anglo-Saxon and Continental systems; its advantages and disadvantages; the Feudal incidents—*e.g.* Aids, Reliefs, Escheat, Wardship, Primer Seisin, etc. (*d*) The Norman judicial system—Witanagemote, Curia Regis, manorial and shire courts. (*e*) The civil war in the reign of Stephen.

Particular care must be taken in traversing the history to trace cause and effect, to watch developments, and to be able to explain them. It is very rare that any striking event occurs, the causes of which have not been secretly operating for a long time. This is particularly true of English history; for the conservative and tenacious Anglo-Saxon element is strongly averse to sudden changes. You will find also that institutions have been moulded by the necessities which arose and which caused their modification. For example, the Magnum Concilium centred in itself the legislative and judicial system; it not only made laws, but tried offenders for the breach of them. This was possible with a small population, but it was inevitable that extension and devolution should come with increase of business. The Curia Regis was established as a *permanent* court, but even that could not cope with the cases which arose, and we have the Justices in Eyre of Henry II., and later on, the organisation of the law-courts by Edward I. The following diagram will explain itself (L = Legislative, J = Judicial, A = Advisory):—



Similarly, the old Baronial courts have become Benches of Magistrates; the Shire Moot has developed into (*a*) Court of Session and Assize Courts, (*b*) County Courts for civil actions. These changes are *growths*, and it is these growths and their causes which must be carefully traced.

So also the feudal system, which suited the age in which it originated, became entirely unsuitable for national needs, and therefore died out.

Unless you can trace any and all of these movements you have not studied your history in the right light.

B. Either of the periods is of course worthy of extended study, but students would do well to take the last, 1815–1870—a period of intense interest to us, as being nearest to our own times. McCarthy's *History of Our Own Times* will be found a very useful book. We shall give a series of notes on the chief aspects and movements of this period. Read for the month the history from 1815 to 1820.

The closing years of George III.'s time were gloomy in the extreme. England had emerged from the titanic struggle with Napoleon victorious, but at a tremendous cost. During that struggle, as is usually the case, the feverish excitement had carried the nation along without time being given to consider seriously how the nation stood. Loan after loan was raised till the National Debt reached the enormous total of over £900,000,000. After Waterloo came the reaction; the country was exhausted, heavy taxation was necessary to pay the interest on the terrific debt, the army was reduced, and men turned to

other employment, at a time when they were not needed. The invention of machinery had thrown many men out of employment, because the increased output of manufactured material was not immediately met with an increased demand. Hence the actions of the Luddites in breaking machinery. In 1815 a Corn Law was passed which excluded foreign wheat till the price of British wheat had risen to the prohibitive price of 80s. per quarter. A series of bad harvests added to the misery already in the country, and riots were common in all parts. The Habeas Corpus Act was suspended from March 3, 1817, to January 1819. In the latter year occurred the "Peterloo" massacre, and the "Six Acts" were passed:—

(1) To prevent Delay in the Administration of Justice.
(2) To suppress Blasphemous and Seditious Libels.
(3) To prevent the Training of Persons in the use of Arms.
(4) To authorise Justices to seize Arms.
(5) To subject certain Newspapers to a Stamp Duty.
(6) To prevent Seditious Meetings.

C. A very useful little book on this section is Wyatt's *The English Citizen; his Life and Duty* (Macmillan). There are other books published or forthcoming, and more advice on the choice of a book will be given next month.

3. *Geography.*

(1) The elements of general and physical geography.
(2) The drawing of simple sketch maps.
(3) Political and economical geography, with special reference to Europe and the British Isles.

This subject will require most thorough work, wide reading, careful analysis and summarising, the committing to memory a host of facts, and the learning of memory maps of all important countries. It demands, perhaps, the hardest work and closest thought of all the subjects.

(1) For this month prepare the earth, its size, shape, motions, longitude, latitude, and the various arbitrary lines marked on a globe. The varying length of day and night, the seasons, the midnight sun, determination of time by longitude and *vice versâ*, the gain or loss of a day travelling round the world eastward or westward.

(2) A memory map of France.

(3) France in detail, paying particular attention to productions, imports and exports, industries, chief towns, and form of government. A superficial knowledge will be of little use.

(4) Revise Asia generally, using sketch maps continually, and take the particular geography of China and Japan.

Optional Subjects.

As stated above, the choice will naturally depend upon the student's knowledge and opportunities. To those who have a fair knowledge of the elements of French this will naturally be one subject. Those who know little had better not attempt it: a year is hardly long enough to reach a fair standard, unless a disproportionate amount of time is devoted to it.

In *Elementary Science* there is a proviso that the candidate must have had "at least thirty hours of practical work in a laboratory or elsewhere." This need not deter the isolated student who is willing to spend a few shillings on apparatus and work experiments under the observation of the head teacher. If this can be done, the subject is an easy one. *Experimental Science*, by Gregory and Simmons, covers most of the course in an admirable manner. For this month take Chapters I.–III.—Lengths, Areas, Volumes, Weights, British and Metric Systems. Work as many of the experiments as you can. If you can make your own apparatus—however rough—it is generally better than manufactured articles.

Elementary Mathematics.—This is a comparatively easy subject. It consists of three parts:—

(*a*) Theory and Practice of Arithmetic. This is the same as the Part I. subject, with the addition of Find Square and Cube Roots by Factors, Practice, Ratio, Proportion, simple questions on Stocks and Shares, without Brokerage.

For this month take finding roots by factors—*e.g.* What is the square root of 1296?

$$\begin{array}{r} 2)1296 \\ 2)\overline{648} \\ 2)\overline{324} \\ 2)\overline{162} \\ 9)\overline{81} \\ \overline{9} \end{array} \quad = 2^2 \times 2^2 \times 9^2 \quad \therefore \text{ the sq. root} = 2 \times 2 \times 9 = 36.$$

Similarly with cube root.

Note that $\left.\begin{array}{l}(a+b)^2 = a^2 + 2ab + b^2 \\ (a-b)^2 = a^2 - 2ab + b^2 \\ (a+b)(a-b) = a^2 - b^2\end{array}\right\}$ where a is one number and b another.

Thus—

$101^2 = (100+1)^2 = 100^2 + 2 \times 100 \times 1 + 1^2 = 1000 + 200 + 1 = 10201$
or $99^2 = (100-1)^2 = 100^2 - 2 \times 100 \times 1 + 1^2 = 10001 - 200 = 9801$
or $(12+7)(12-7) = 12^2 - 7^2 = 144 - 49 = 95.$

By what number must 2516 be multiplied to make a perfect square?

The factors of $2156 = 2 \times 2 \times 7 \times 7 \times 11$, or $2^2 \times 7^2 \times 11$. Hence it is evident that if the number is multiplied by 11 the result is a perfect square.

(*b*) *Algebra* as far as Simultaneous Equations of two unknowns. For this month take Substitution of Numerical Values, Insertion and Removal of Brackets.

(*c*) Geometry, Practical. Bisection of angles and straight lines, and construction of perpendiculars. (Rawle's *Geometry* is cheap and good.)

Euclid.—Definitions, Axioms, and Postulates, with Propositions 1–6.

Next month complete tests will be given on each subject.

All students are cordially invited to write for assistance on any matters connected with their work. Letters should be sent to Arthur T. Flux, Oakleigh, Belvedere, Kent, and *must* contain the coupon of the current number of the paper, and a stamped addressed envelope if a reply is needed other than through the correspondence column.

OUR CERTIFICATE COURSE FOR 1906.

BY GEORGE COLLAR, B.A., B.SC.,

Head-Master of Stockwell Pupil-Teacher School.

WE have now gone through the syllabus as fully and as thoroughly as our space will permit, and trust that our readers will devote as much time as possible to revision. The test questions set each month are valuable helps in revising the work of the previous month, and a general examination will now be of great use if carried out in the proper way, and will not only suggest points to which special attention must be paid in the final revision, but will afford valuable practice in the way of dealing with questions in the examination room.

These questions should be answered under conditions as nearly as possible identical with those of the Government Examination itself. No notes or text-books should be referred to from the time of first seeing the questions to the time of completing the answers. Each paper should be worked at one sitting, and within the time allowed for it. Practice in writing the required particulars at the top of each paper will lead to a considerable saving of time in the examination itself, and will help to avoid what might be an unfortunate accident. Read all the instructions carefully, noting how many questions you may attempt, which questions are compulsory, and the special methods, if any, you are required to adopt. You should then read through all the questions very carefully. If a choice is given you, you will then be able to select those you can answer best. But even if you have to answer all the questions, it is advisable to read them all carefully before beginning to answer any. This will give you a general idea of the lines on which the examiner wants the answers to run, and sometimes you can pick up bits of information or suggestions from one question which will help you to answer another; you can also discover which are the easiest questions, and unless you are told especially to answer the questions in the order in which they come, it is advisable to begin with those you can answer best. In examinations a candidate often begins with a difficult question, and spends so much time in ineffectual attempts to answer it that he has none left for questions that are easily within his powers. Whereas, if he had attempted the easy ones first, he would not only have some completed answers to show at the end of the examination, but the confidence arising from success in dealing with one question is a great help towards the successful handling of another. These remarks apply both to the present test and to the July examination. In addition we may say that it is impossible for us to revise all the papers worked by our readers, and we cannot mark more than the papers of those who have been sending their work regularly throughout the year. Other students should endeavour to get their answers tested by a competent critic who will go through the results orally with them.

ARITHMETIC (*Two hours allowed*).

(*You may attempt all the questions.*)

1. What do you mean by a "prime number"? Say which of the following numbers are prime, and give the factors of the others: 377, 4285, 1913, and 569.

Show that if a prime number divides the product of two other numbers, one of which is prime, it must be a factor of the other.

2. What principles will enable you to compare two vulgar fractions by inspection? Arrange the following fractions in order of magnitude: $\frac{4}{13}$, $\frac{11}{37}$, $\frac{33}{101}$, $\frac{3}{12}$, $\frac{111}{303}$.

3. State and prove the rule for dividing one vulgar fraction by another; and explain why the quotient is greater than the dividend when the divisor is a proper fraction.

4. Subtract $3{\cdot}0\dot{4}\dot{2}\dot{1}\dot{5}$ from $71{\cdot}2\dot{9}\dot{4}$, without reducing to vulgar fractions. Give the denominators of all the vulgar fractions having 1 as the numerator, which produce decimals recurring in three places.

5. What advantages will be gained by the introduction of the Metric System into this country? Give the approximate British equivalents of the kilogramme, the metre, the kilometre, the franc, and the hectolitre. If a merchant bought wine at 55 francs the double hectolitre, and paid 1s. 3d. per gallon duty on it, at what price per gallon must he sell it to gain 20 per cent.? Give your answer to the nearest penny.

6. A merchant bought a cargo of tea, and sold 25 per cent. of it at a profit of 25 per cent., and 45 per cent. of it at a profit of 10 per cent.; on the remainder he lost 2 per cent. What was his gain or loss on the whole?

7. The road from A to B consists of 3 miles uphill, 4 miles level, and 5 miles downhill. I can walk $\frac{3}{4}$ mile uphill and $\frac{1}{4}$ mile downhill in $25\frac{1}{2}$ minutes. If it takes me $3\frac{1}{2}$ hours to walk from A to B, and 4 hours 6 minutes to walk from B to A, how many miles per hour do I walk on level ground?

8. Work the following by the shortest methods:—

(i.) 120 articles at 19s. 11½d. each.

(ii.) 9993×9996.

(iii.) Reduce $\frac{3}{4}$ of 4s. to the decimal of £1.

(iv.) Reduce £·489375 to shilling and pence.

(v.) Find the square root of $25 \times 49 \times 47 + 25 \times 49 \times 97$.

ENGLISH COMPOSITION (*One hour allowed*).

Write an essay on one of the following subjects;—

(*a*) The Algeciras Conference.

(*b*) "Where ignorance is bliss
'Tis folly to be wise."

(*c*) Nature study for school children.

ENGLISH LANGUAGE AND LITERATURE.

Answer *two* questions from each of the first two sections and one from each of the other sections.

SECTION I.

Milton: *Paradise Lost*, Book VI., and the *Sonnets*.

1. Give an outline of the course of action in this book.

2. Under what poetical forms does Milton describe the arms of his own time?

3. Explain carefully the meaning of two of the following passages:—

(i.) On they move,
Indissolubly firm; nor obvious hill
Nor straitening vale, nor wood, nor stream divides
Their perfect ranks; for high above the ground
Their march was, and the passive air upbore
Their nimble tread. As when the total kind
Of birds, in orderly array on wing,
Came summoned over Eden to receive
Their names of thee; so over many a tract
Of heaven they marched, and many a province wide,
Tenfold the length of this terrene.

(ii.) Such destruction to withstand
He hasted, and opposed the rocky orb
Of tenfold adamant, his ample shield,
A vast circumference. At his approach
The great Archangel from his warlike toil
Surceased, and, glad as hoping here to end
Intestine war in heaven, the Arch-foe subdued
Or captive dragged in chains, with hostile frown
And visage all inflamed, first thus began.

(iii.) Methought I saw my late espoused saint
Brought to me, like Alcestis, from the grave,
Whom Jove's great son to her glad husband gave,
Rescued from death by force, though pale and faint.

(iv.) Thou honour'st verse, and verse must lend her wing
To honour thee, the priest of Phœbus' quire,
That tunest their happiest lines in hymn or story,
Dante shall give fame leave to set thee higher
Than his Casella, whom he wooed to sing,
Met in the milder shades of purgatory.

4. What is the standard form of a sonnet? Point out the chief variations, and name the chief English writers of sonnets.

SECTION II.

Lycidas and the *Arcopagitica*.

1. Why is "Lycidas" called a pastoral and an elegy? In which two passages does it cease to be either one or the other? What, according to Milton's own introductory note, are its apparent purpose and its real purpose?

2. Give some of the chief references in "Lycidas" to pagan mythology and to Christian doctrine, and say how you would justify the use of both in the same poem.

3. When was the freedom of the press eventually established? State fully the arguments that may be urged in favour of imposing some restrictions upon it. Show how such restrictions when imposed have acted.

4. Explain three of the following passages:—

(*a*) But saith the historian Socrates, the providence of God provideth better than the industry of Apollinarius and his son, by taking away that illiterat law with the life of him who devis'd it.

(*b*) The villages must have their visitors to enquire what lectures the bagpipe and rebbeck reads even to the ballatry and the gammuth of every municipal fidler, for these are the Countryman's Arcadias and his Monte Mayors.

(*c*) Next, Camus, reverend sire, went footing slow,
His mantle hairy, and his bonnet sedge,
Inwrought with figures dim and on the edge
Like to that sanguine flower inscribed with woe.
"Ah! who hath reft," quoth he, "my dearest pledge?"

(*d*) O fountain Arethuse, and thou honoured flood,
Smooth sliding Mincius, crowned with vocal reeds,
That strain I heard was of a higher mood.
But now my oat proceeds,
And listen to the Herald of the Sea,
That came in Neptune's plea.

SECTION III.

1. Name the authors of four of the following extracts, and show by further quotation or description that you are acquainted with the poems from which the extracts are taken.

(*N.B.*—You are not required to write notes on the language or allusions of the extracts themselves.)

(*a*) He nothing common did or mean
Upon that memorable scene,
But with his keener eye
The axe's edge did try.

(*b*) — This man is freed from servile bands
Of hope to rise, or fear to fall;
Lord of himself, though not of lands;
And having nothing, yet hath all.

(*c*) Lay thy bow of pearl apart
And thy crystal shining quiver;
Give unto the flying hart
Space to breathe, how short soever.
Thou that mak'st a day of night,
Goddess excellently bright.

(*d*) Go, lovely Rose!
Tell her, that wastes her time and me,
That now she knows,
When I resemble her to thee,
How sweet and fair she seems to be.

(*e*) He sung Darius great and good,
By too severe a fate
Fallen, fallen, fallen, fallen,
Fallen from his high estate,
And weltering in his blood;
Deserted at his utmost need
By those his former bounty fed;
On the bare earth exposed he lies
With not a friend to close his eyes.

(*f*) He hangs in shades the orange bright
Like golden lamps in a green night
And does in the pomegranates close
Jewels more rich than Ormuz shows;
He makes the figs our mouths to meet
And throws the melons at our feet.

(*g*) Call up him that left half-told
The story of Cambuscan bold,
Of Camball, and of Algarsife,
And who had Canacé to wife
That owned the virtuous ring and glass.

SECTION IV.

Woodstock and *The Fortunes of Nigel.*

1. Give a brief description of any scene in *Woodstock* that seems to you to be particularly dramatic.
2. Give an account of Nigel's sojourn in Alsatia.

SECTION V.

Pepys' Diary, Memoirs of Colonel Hutchison.

1. What do you know of the circumstances attending the writing and publication of *Pepys' Diary*? To what characters does it owe its importance?
2. Give an account of the Campaign of 1643 from the *Memoirs of Colonel Hutchison.*

THEORY OF TEACHING (*Three hours allowed*).

Not more than six questions may be answered.

1. Suggest methods by which children in the elementary schools may be trained to acquire knowledge for themselves.
2. Draw up a scheme for teaching grammar and composition concurrently.
3. To what extent is it advisable to give children set lessons in morals—apart from "Scripture" lessons? If this is not done, in what ways can the moral training of children be attended to in school?
4. How would you set about "nature study" in a school situated in the heart of a large town, and what advantages would the children derive from such a course?
5. What is the earliest time at which decimal fractions can be introduced, and how can the teaching of decimal fractions be best grafted on to the teaching of work by whole numbers?
6. What are the "five points" under which notes of a lesson should be arranged? Show that this arrangement is correct from a psychological point of view.
7. What were the leading ideas in the methods of Frœbel?
8. Give a short sketch of the life and work of Pestalozzi.
9. What should be the aims of the history teaching in the elementary school? In what ways should the lessons in English history be associated with teaching in European or ancient history, or with civic instruction?
10. Describe any excursion on which you have accompanied your children for the purpose of historical or geographical study.
11. Discuss the ways in which the various subjects of the school curriculum may be correlated so as to be mutually helpful.
12. What are the special points to attend to in the physical training of school children? Of what length should each lesson in this subject be, and how many lessons should there be per week?

ENGLISH HISTORY (*Two hours allowed*).

Answer eight questions, four from each Section.

SECTION I.

1. What were the rights and duties of the king in Anglo-Saxon times? How was justice then administered?
2. Compare Anselm, Flambard, and Lanfranc as types of the mediæval clergy; and describe the disputes on the question of investiture.
3. Examine the general aims and results of John's foreign policy, and account for his failure to retain or recover his French territories.
4. Write a connected account of the last fifteen years of Henry III.'s reign, noting in their proper place the importance of the constitutional documents connected with Amiens, Kenilworth, Lewes, and Oxford.
5. Name six great men other than Englishmen who were living at the death of Henry VII., and who had some connection with English history. Write a few notes about each.
6. In what ways, for what objects, and with what results did Great Britain take part in the War of the Austrian Succession?
7. Point out the immediate causes of the Union of Great Britain and Ireland. What were the chief provisions of the Act of Union, and how were they subsequently modified?
8. Trace the growth of the Cabinet under the first three Georges in relation to both the kingship and the Parliament.

SECTION II.

1. During which periods did Charles I. govern without a Parliament, and how did he provide the necessary money?
2. Write a short life of two of the following:—Archbishop Laud, Pym, Hampden, and Prince Rupert.
3. In the Civil War, which districts and which classes of people sided with the King and which with the Parliament? How can you explain the division?
4. How was the friendship which existed between England and Holland in the times of Elizabeth converted into enmity later on? Trace the course of the struggle.
5. What do you understand by the Clarendon Code? What was the effect of these Acts, and when were they repealed?
6. How does the treatment of Danby illustrate the theory of the responsibility of the King's ministers?
7. Give a short account of the various "plots" which were formed in the reigns of Charles II. and James II.
8. Give an account of Monmouth's rebellion, and say in what ways Argyle was connected with it.

GEOGRAPHY (*Two hours allowed*).

Answer eight questions.

1. Give an account of Italy under the following heads:—(*a*) size and configuration, (*b*) chief mountains and rivers, (*c*) towns, accounting for their position, (*d*) industries and manufactures.
2. Compare the climate of France and Russia, and mention the effects of the differences on the productions and people.
3. Give an account of German commerce, saying how it is being fostered, and in what directions it is being extended.
4. Write an account of the chief plains of Europe.
5. Contrast the eastern and western sea-boards of the Dominion of Canada.
6. Describe the chief means of communication in North America.
7. Give an account of the geography of Newfoundland, and write a few particulars of the Anglo-French agreement affecting the claims of fishermen.
8. Classify the West India Islands: (*a*) according to situation, (*b*) according to government or political connection with other states.
9. Point out the advantages of situation which fit Great Britain for its immense *entrepôt* trade.
10. Explain as far as you can the reasons for the position of the French woollen industry and also of the cotton industry.
11. What advantages would be gained by establishing a line of steamers to Hudson's Bay, and how would this affect any existing Canadian ports?
12. Give a description of the iron and steel industry of the United States, and account for its remarkable development.
13. What conditions favour the rise of a seaport? Show how Liverpool and Bristol are affected by these conditions.
14. Write a short account of Bergen and of Stockholm, and account for the difference between their climates.
15. Write a short account of the State of California.
16. How can the latitude of a place be determined? Why does the length of a degree of latitude vary in different parts of the earth?

GEOMETRY (*Two hours allowed*).

All questions may be attempted.

1. ABCDEF is an irregular hexagon. Show that if the angles at A, C, and E are together equal to those at B, D, and F, the circumference of a circle may be drawn passing through all the angular points of the figure.
2. Through any point, O, in a circle two chords, AB and CD, are drawn at right angles to each other; prove that the chords AC and BD are together equal to the chords AD and BC.
3. PQRS is a semicircle, of which PS is the diameter, PR is produced to V, and QR joined. Show that the angle QRV is obtuse.
4. Prove that in a right-angled triangle the square on the hypotenuse is equal to the sum of the squares on the other two sides.
5. A and B are two points 4 cm. apart; find a point C, 5 cm.

from A and 3 cm. from B, and draw a circle passing through the three points. Show that AC must be the diameter of the circle.

6. Take a line AB 6 cm. in length, from A as centre draw a circle of 2 cm. radius, from B as centre draw a circle of 3 cm. radius. Draw a common tangent to the two circles.

7. Draw a straight line 5 cm. in length, and divide it in the ratio $\sqrt{3}:1$.

8. Show how to divide a line externally so that the rectangle contained by its segments shall be equal to a given square. When is this impossible?

ALGEBRA (*Two hours allowed*).

Eight questions may be answered.

1. If a men and b boys unload a ship in c days, and A men and B boys unload it in C days, in how many days will $A+a$ men and $B+b$ boys unload it?

2. How would you illustrate to a class of beginners that $l+(m-n)=(l+m)-n$?

If $a=\frac{1}{1-b}$, and $b=\frac{1}{1-c}$, prove that $c=\frac{1}{1-a}$.

3. Divide $2a^2-3b^2+c^2+2ab+3bc+3ca$ by $c+a-b$, and also (separately) by $a+c-b$.

[The order of the letters must not be changed.]

Find the difference between the two remainders.

4. Write down (without multiplying out, if you can) the term independent of x in the expression

$$\left\{x^3-a^2+\frac{a^4}{x^3}\right\}\{x^2+3ax+2a^2\}$$

5. Two workmen are engaged on a piece of work. The first works at it alone for a third of the time that the second would take to complete it; then the second works for a third of the time that the first would take to complete it. It is then found that $\frac{1}{2}\frac{1}{4}$ of the work has been done. If the two men working together could do the whole work in $3\frac{1}{3}$ hours, find how long each one would take to do it separately.

6. Solve the equations:—

(i) $$\frac{\frac{x-a}{b}+\frac{x-b}{a}}{\frac{x+c}{a+b+c}}=\frac{(a+b)^2-(a-b)^2}{\frac{2a+2b}{\frac{1}{a}+\frac{1}{b}}}.$$

(ii) $$\begin{cases} x+y-z=2c \\ y+z-x=2a \\ ax+by+cz=2(ab+bc+ca). \end{cases}$$

7. Prove the identity:—

$$\frac{a(b-c)}{b+c}+\frac{b(c-a)}{c+a}+\frac{c(a-b)}{a+b}+\frac{(b-c)(c-a)(a-b)(a+b+c)}{(a+b)(b+c)(c+a)}=0.$$

8. Find the Highest Common Factor and the Lowest Common Multiple of

$$30a^3b^2c(a^2-b^2),\ 36a^2bc^2(a-b)^2,\text{ and }48a^2b^2c(a^2-b^2).$$

ELEMENTARY SCIENCE (*Three hours allowed*).

Not more than eight questions are to be attempted altogether, of which four must be taken from each section.

SECTION I.

1. State Boyle's Law, and describe with sketches how you would prove it.

2. What is weight? How would the weight of the same body vary, (*a*) at the top of a high mountain, (*b*) at sea level, (*c*) down in a deep mine?

3. How can you prepare ammonia gas, and how would you illustrate its chief properties?

4. How is the eclipse of the moon caused? Illustrate your answer by a diagram, and say why we do not have an eclipse of the moon every month.

5. Explain fully the statement—"Heat is a form of Energy." Mention other forms of energy and show that one may be converted into the others.

6. State the laws of reflection of light, and show that a man can see the whole of his person reflected in a vertical plane mirror the length of which is equal to half his own height.

7. By what signs can you detect whether an electric current is flowing along a wire, and how can you tell the direction of the current?

8. What is a volcano? How has the surface of the earth been modified by volcanic action?

SECTION II.

1. Discuss the differences between a fern and a bean plant.

2. Describe the functions of each part of a perfect flower, and mention a few cases of special modification of flowers which insure cross fertilisation.

3. In which parts of a plant is starch produced? Describe experiments in illustration of your answer, and mention parts of plants in which starch is to be found in large quantities.

4. Describe the various means by which seeds are distributed.

5. Give a short account of the circulation of the blood.

6. Describe the changes that take place in air during respiration. How do fishes breathe?

7. Describe the structure of two typical forms of teeth. Mention some striking peculiarities in the teeth of animals, and show how the teeth of animals form a good basis for classifying them.

8. Write notes of a lesson on the feet and beaks of birds.

9. What is about the quantity of air taken into the lungs in respiring, and at what rate does a room require ventilating?

10. What are the chief classes of food-stuffs, and how much of each is required by an adult? What conditions will cause this amount to vary?

11. What are the properties of good drinking water, and how can you tell whether water is suitable for drinking?

12. Why is exercise necessary for the maintenance of health? How much should be taken? Mention suitable forms and show the harm that arises from subjecting young children to excessive fatigue.

FRENCH (*Two hours allowed*).

All the questions may be attempted.

1. Translate into English:—

Toujours du plaisir n'est pas du plaisir.

Un souverain d'Orient, célèbre par sa sagesse, recevait tous les jours des plaintes contre un de ses parents, gouverneur d'une province importante de son empire, nommé Iran. C'était un homme de haute naissance, dont le fond n'était pas mauvais, mais qui était corrompu par la vanité et la mollesse. Il souffrait rarement qu'on lui parlât, et jamais qu'on osât le contredire. Il ne respirait que la gloire et les faux plaisirs. Le monarque entreprit de le corriger.

Il lui envoya un chef de musique avec douze chanteurs et vingt-quatre instrumentistes, un maître d'hôtel avec six cuisiniers, et quatre chambellans qui ne devaient pas le quitter.

Le premier jour, dès qu'Iran fut éveillé, le maître de musique entra suivi des chanteurs et des instrumentistes; on chanta une cantate qui dura deux heures et dont le refrain célébrait ses mérites. Un chambellan lui fit ensuite une harangue de trois quarts d'heure dans laquelle on le louait de toutes les bonnes qualités qui lui manquaient. La harangue faite, on le conduisit à table au son des instruments. Le dîner dura trois heures. Dès qu'il ouvrait la bouche pour parler, le premier chambellan disait: "Il aura raison." A peine avait-il prononcé quatre paroles que le second chambellan s'écriait: "Il a raison." Après le dîner, on lui répéta la cantate.

Cette première journée lui parut délicieuse. Il trouva que le roi l'honorait selon ses mérites. La seconde lui parut moins agréable; la troisième fut gênante; la quatrième fut insupportable; la cinquième fut un supplice. Il écrivit à la cour pour supplier le roi qu'il daignât rappeler ses chambellans, ses musiciens, son maître d'hôtel; il promit désormais d'être moins vain et plus appliqué. Il se fit moins encenser, eut moins de fêtes et fut plus heureux, car, comme dit un auteur oriental: "Toujours du plaisir n'est pas du plaisir."

VOLTAIRE (*Contes*).

2. Translate into French:—

Under the reign of Queen Elizabeth the commerce of England in general, and of London in particular, became for the first time of world-wide importance and of world-wide scope. All the sovereigns of the Tudor dynasty had zealously encouraged and fostered trade. But Elizabeth did more than anyone to set London at the head of the seaports of the world, and with her efforts in this direction the name of Sir Thomas Gresham is inseparably associated. The great stimulus to English trade was given by the discovery of new lands and new routes, and when once the merchants of London had fully realised what the opening up of new lands might mean for them, the prosperity of London increased by leaps and bounds.

OUR SCIENCE SECTION

☞ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this number.**

NOTES ON PHYSICS.

BY EDWIN EDSER, A.R.C.SC.

Author of "Heat for Advanced Students," "Light for Students," "Differential and Integral Calculus for Beginners," etc.

Heat.

A Bunsen-burner gives more light when the air-holes are stopped up than when they are open. Why is this? Does it also produce more heat? If it does, why does it? If it does not, then why does a thermopile, placed to receive the radiations of the flame, indicate an increased effect when the air-holes of the burner are closed?

University of London, Inter. Sci. Hons., 1900.

The fact that the flame gives increased light when the air-holes are closed merely shows that a greater proportion of energy is then radiated in the form of waves of short length. The indications of the thermopile show that the total amount of energy radiated by the flame is increased by closing the air-holes. Now the amount of energy given off by a body in the form of radiations depends on two factors: first, the temperature; and second, the emissivity of the flame. If either of these quantities is maintained constant, an increase in the other will produce an increase in the energy radiated from the flame.

Now if the gas is finally converted by complete combustion into hydrogen and carbon-dioxide, the amount of heat produced is fixed: this amount is the same, whether the flame is luminous (but not smoky) or non-luminous. The temperature of the non-luminous flame is, however, lower than that of the luminous flame; this is due to the fact that the temperature of the air admitted to the non-luminous flame by way of the air holes has to be raised at the expense of the heat generated by combustion. Further, the emissivity of the flame is increased by closing the air-holes. This is due to the fact that, as a first stage in the combustion produced in the luminous flame, small particles of carbon are formed, and these, being raised to the temperature of the flame, radiate much as a black body would if raised to the same temperature. If an incandescent mantle is placed in the flame, a greater amount of light is given off, owing to the fact that the white mantle radiates less energy per second than a black body at the same temperature; consequently the temperature of the non-luminous flame, and the mantle which it surrounds, is higher than that of the luminous gas flame, and an increase in temperature entails an increased radiation of waves of short length. It has been found, however, that the temperature of the flame surrounding the mantle is lower than that of the non-luminous flame in the absence of the mantle, owing to the fact that the emissivity of the mantle is greater than that of the non-luminous flame.

Light.

Visual Luminosity of Images. The following laws relating to the visual luminosity of images are of importance:—

So long as the diameter of the pupil of the eye remains constant, the visual brightness of an object will remain the same at whatever distance from the eye it may be placed. The visual brightness of an object depends on the amount of light falling on unit area of the image formed in the eye. Now, if a luminous object is successively placed at different distances from the eye, the amount of light from it which enters the pupil is inversely proportional to the square of the distance of the object from the eye. This is a particular application of the inverse square law used in photometry. The whole of the light passing through the pupil goes to form the image on the retina. The linear dimensions of the image are inversely proportional to the distance of the object from the eye, so that the *area* of the image is inversely proportional to the square of this distance. Hence as the object is moved farther away from the eye, the total amount of light which forms the image on the retina decreases in just the same proportion as the area of the image (*i.e.* if the object is taken twice as far away, the total amount of light which enters the pupil is reduced to one-fourth of its original amount, the linear dimensions of the retinal image are diminished to one-half, and the area of the image to one-fourth of its original value). Hence the light falling on unit area of the image is the same in all cases, and therefore the visual brightness of an object is independent of its distance from the eye.

In the above it is assumed that the atmosphere is perfectly transparent; if this is not the case, the object will lose in visual brightness as it is taken farther from the eye. This effect would only be apparent when an object is viewed from a great distance through the atmosphere.

It is also assumed that a true image is formed on the retina. This is not the case when the retinal image becomes very small. The image of a star, for instance, would be so small, if the laws of geometrical optics were followed, that it would differ but little from a geometrical point. Owing to the fact that light consists of waves, the image of a star formed by the most perfect lens will always have finite dimensions: the wider the aperture of the lens, the smaller will be the image formed (see *Light for Students*, p. 446). Besides this, the crystalline lens of the eye, as a lens, is very defective: it possesses a structure which causes the radial bright lines which are seen when a star or other distant source of bright light is viewed by the unaided eye.

To observe the radial structure of the crystalline lens, place a bright flame behind a screen provided with a pinhole, form in the air a real image of the pinhole by means of a convex lens of about 10 inches focus, and then place the eye close up to the image: the shadow of the crystalline lens is then thrown on the retina, and the appearance presented is shown in Fig. 1, which is taken from a paper on Entoptic Vision, by Professor W. F. Barret, F.R.S.[1]

FIG. 1.

If we neglect the loss of light due to reflection from the faces of a lens, and also the imperfect transparency of the glass, the visual brightness of an image formed by the lens is just equal to that of the object seen by the unaided eye.

Let the object be placed at a distance u from the lens, while its image is formed at a distance v from the lens. Then the magnification is equal to v/u, and therefore the area of the image is v^2/u^2 times the area of the object. The image is formed by those rays from the object which pass through the lens. The lens subtends at the object a solid angle equal to a/u^2, where a is the area of the lens; at the image the lens subtends a solid angle equal to a/v^2. Hence those rays from the

[1] *Proceedings of the Royal Dublin Society*, vol. xi. (N.S.), No. 8, Fig. 5, Plate IV.

object which pass through the lens are included in a cone of solid angle a/u^2; the image is formed by a cone of rays of solid angle a/v^2, and these rays, diverging from the image, serve to render it visible. The smaller the solid angle a/v^2, the greater is the radial concentration of the rays; if we increase the angle a/v^2, the rays diverge at a greater angle from the image, and fewer of them can fall on a given area (such as the pupil). Now if we make the image smaller than the object, more light will leave unit area of the image than unit area of the object, the ratio of the two being

$$\frac{\text{area of object}}{\text{area of image}} = \frac{u^2}{v^2}.$$

But the rays leave the image in a cone of solid angle a/v^2, and the same rays left the object in a cone of solid angle a/u^2, so that the radial concentration of the rays has been diminished in the ratio v^2/u^2. Hence the area of the image and the radial concentration of the rays which form it increase or decrease with each other; with the result that the brightness of the image is always the same, and is equal to that of the object. Perhaps this may be made clearer by considering the object to be a series of luminous points; if the image is smaller than the

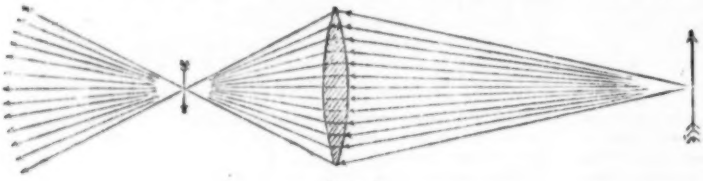


FIG. 2.

object, the luminous points will be closer together in the image than in the object; but the rays leaving any luminous point of the image diverge more rapidly than those leaving the corresponding point of the object (see Fig. 2).

Since some light is reflected from each surface of the lens, and some more light is absorbed in passing through the substance of the lens, it follows that the image is really slightly less bright than the object. Thus, an object, when viewed through a telescope, microscope, or other piece of optical apparatus, can never appear quite so bright as when it is viewed by the unaided eye.

This law only applies when a true image, following the laws of geometrical optics, can be formed. When a lens is used to form the image of a star, the image becomes smaller and smaller as the aperture (or diameter) of the lens is increased, the focal length remaining constant. Hence in viewing a star a gain in brightness will follow the use of an object-glass of wider aperture. In order that the brightness of the image seen through a lens or system of lenses should be approximately equal to that of the object, the rays which finally emerge must form a pencil wide enough to fill the pupil; if this is not the case, the brightness will be the same as if the pencil had been wider and the pupil had contracted; *i.e.* the brightness will be greatly diminished.

How does the brightness of a star as seen in a telescope depend upon the magnifying power and upon the aperture? Loss of light by reflection and absorption need not be considered.

University of London (External Students), B.Sc. Pass, 1903.

As explained above, the wider the aperture of the object-glass of a telescope, the smaller (and therefore the brighter) will be the image of a star formed by it. If the aperture is

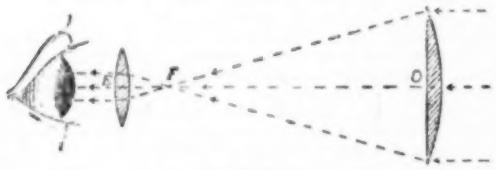


FIG. 3.

kept constant, then the brightness of the star (seen against the dark night sky) will remain constant so long as the pencil of rays emerging from the eyepiece is sufficiently wide to fill the pupil. An expression for the diameter of the pencil emerging from the eyepiece will now be found.

In Fig. 3, let O represent the object-glass of a telescope directed toward a star; the rays from the star which fall on O are parallel, and after passing through O are brought to a focus at F, the second principal focus of O. The eyepiece lens E is arranged so that, after passing through it, the rays which diverged from F are rendered parallel, when they are in a condition to be brought to a focus on the retina without any accommodation of the eye. Hence the distance EF is equal to the focal length f of the eyepiece lens E. Now let e be the diameter of the pencil of rays emerging from the eyepiece lens E, while a is the aperture or diameter of the object-glass O; then it is easily seen that

$$\frac{e}{a} = \frac{f}{F},$$

where F = the focal length OF of the object-glass O.

$$\therefore \quad e = \frac{af}{F}.$$

So long as e is wider than the pupil of the eye, the brightness of the star seen by a lens of aperture a will be independent of the ratio f/F; always provided that the image is not distorted owing to spherical or chromatic aberration in the lenses. If e is less than the diameter of the pupil, the apparent brightness of the star will be diminished, just as if the pupil had contracted.

F/f is numerically equal to the magnifying power of the telescope. This is the ratio of the angle subtended at the eye by the image of a distant object seen through the telescope, to the angle subtended at the eye by the object itself. Let U be the distance from the first principal focus of the objective to the distant object; then the magnification of the image formed by the objective is equal to F/U (see *Practical Teacher* for May 1906, p. 603); therefore the size of the real image formed by the objective is equal to $\frac{oF}{U}$, if the size of the object is o. Let the image formed by the eyepiece lens be at a distance V′ from the second principal focus of the lens; then the magnification due to the lens will be equal to $(-V'/f)$ (*Practical Teacher*, May 1906, p. 603), and the size of the image seen by the eye will be

$$-\frac{oF}{U} \cdot \frac{V'}{f}.$$

The eye will be placed near the second principal focus of the eyepiece lens, so that the image will be at a distance V′ from the eye; hence the angle subtended at the eye by the image

$$= -\frac{oFV'}{U \cdot f} \div V' = -\frac{oF}{Uf}.$$

Since the object is at a great distance, its distance from the eye will not be materially greater than its distance U from the first principal focus of the objective; hence the angle subtended at the eye by the object $= \frac{o}{U}$.

Thus magnifying power of telescope

$$= \frac{\text{angle subtended by image}}{\text{angle subtended by object}} = -\frac{\frac{oF}{Uf}}{\frac{o}{U}} = -\frac{F}{f}.$$

You are given an astronomical telescope focussed for an infinite distance and pointing at the daylit-sky. You are given a rule, a finely divided scale, and a pocket lens. How would you find the magnifying power of the telescope, and how would you satisfy yourself that your result was not vitiated by stops in the telescope?

Give the theory of the method when the eye-piece is a single convex lens.

University of London (External Students), B.Sc. Pass, 1902.

Place a ground-glass screen behind the eyepiece, and adjust this so that the small circular image formed by the emerging rays is sharply focussed. This is the image of the object-glass formed by the eyepiece lens or lenses. Measure the diameter of the image: let this be equal to d. Now measure the diameter of the object-glass: let this be equal to D. Then, if no light is cut off by stops inside the telescope, the magnifying power is equal to D/d. In order to determine whether stops inside the telescope cut off any of the light, and so vitiate the result, a pin may be placed with its point projecting inwards just over the edge of the objective; if an image of the pin point can be seen on the ground-glass screen,

the observation is not vitiated by the presence of stops. If the image of the pin is not seen, two pins should be placed so that they project inwards over the edge of the objective; adjust these till the points of both pins are seen in the image. Then if D is the actual distance between the points of the pins, and d is the distance between the images of these points, the magnifying power is D/d.

The theory of this experiment is as follows: The eyepiece of focal length, f, forms on the ground-glass screen an image of the illuminated circular space occupied by the object-glass. The object-glass is at a distance F from the first principal focus of the eyepiece lens (F being the focal length of the objective), and hence the magnification of the image formed on the screen is equal to f/F; hence

$$\frac{d}{D} = \frac{f}{F},$$

and the magnifying power of the telescope, viz., F/f, is equal to D/d.

Electricity and Magnetism.

What is meant by an electric image? A charge of electricity $\delta + q$ is situated at a distance l from a large earthed plane conducting sheet. Find the distribution of the induced charge in terms of the distance from the point.

University of London (External Students), B.Sc. Pass, 1905.

When a small body carrying an electric charge is placed in the neighbourhood of an earthed conductor, the distribution of the lines of force in the space outside the conductor is generally different from that which would be found if the conductor were removed. This distribution is, however, identical with that which would be produced if the earthed conductor were removed and a charge, equal in magnitude but opposite in sign to that carried by the small charged body, were placed at some point within the space previously occupied by the conductor. This opposite charge is called the *electric image* of the original charge, with respect to the given conductor. It must be remembered that there is no field of force inside a conductor. If the conductor were removed, and a charge opposite to the original one were placed in the position of the electric image of the latter, a field of force would be produced in the space previously occupied by the conductor: this field would not correspond to anything found in the original circumstances. It is only in the space outside the conductor that the fields would be identical in the two cases. Hence *a charge and its electric image with respect to an earthed conductor together produce a field, in the space outside the conductor, which is identical with that due to the charge and the earthed conductor.*

The second part of the question exemplifies the use of an electric image in obtaining the surface distribution of electricity over an earthed conductor placed near an electric charge. The following principles must be remembered:—

Lines of force always end normally on a conducting surface. This is due to the fact that a line of force tends to contract, and that the end of a line of force can move freely over a conductor. Hence, if the line of force, where it ends on a conducting surface, were inclined to this surface, the tension of the line of force would drag its end along the surface until the line ended normally on the surface: in this latter condition the tension of the line would tend merely to pull its end normally away from the surface, but not along the surface.

Similarly directed lines of force repel each other laterally. If we consider lines of force to be tubes, and not mathematical lines, the above result may be expressed by saying that each tube tends to swell laterally, or to acquire greater girth. Space being filled with these tubes, the lateral swelling of one can only occur at the expense of the lateral compression of others; and as the tendency to swell is inversely proportional to the sectional area of a tube, it is clear that a condition of equilibrium will be eventually attained in which the further swelling of any one tube will be prevented by the similar tendency of the neighbouring tubes.

Hence, *the lines (or tubes) of force will ultimately distribute themselves in such a manner that they are in equilibrium under the action of their longitudinal tensions and their lateral pressures.*

Fig. 4 represents the lines of force due to two numerically equal charges with opposite signs. Each line of force tends to contract, but some lines are forced to take a roundabout course from one charge to the other on account of the lateral repulsion of neighbouring lines which follow a more direct course.

Let AB be the section of an imaginary plane drawn through the point midway between the two charges and perpendicular to the line joining these. It is obvious that each line of force cuts this plane normally.

Now suppose AB to be the section of a thin plane conducting sheet: all lines of force will enter this sheet normally, and therefore their longitudinal tensions will merely tend to drag their ends normally away from the sheet. Their lateral repulsion will remain the same as before, and therefore the distribution of lines of force will remain unaltered. There will be no

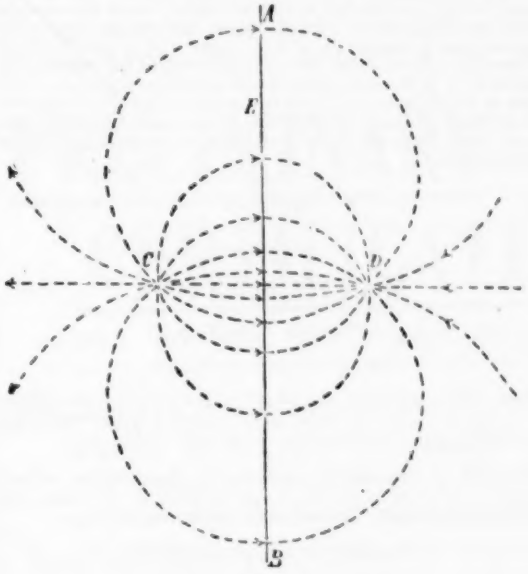


FIG. 4.

lines of force within the *substance* of which the conducting sheet is composed: each line of force leaving the (+) charge ends on the left-hand side of the sheet, then springs off from the right-hand side of the sheet, and finally ends on the negative charge. Thus each line of force is divided into two parts by the conducting sheet, and either of these is independent of the other: this follows from the circumstance that each line of force is in equilibrium under the action of its longitudinal tension and its lateral pressure, and neither of these properties can be affected by the lines of force on the opposite side of the sheet.

Let us now suppose that the negative point charge on the right-hand side of the conducting sheet is momentarily connected to the latter by a conducting wire: in this case, all the lines of force to the right of AB disappear, while those to the left of AB remain unaffected. The distribution of lines of force to the left of AB is now identical with that which would be produced if AB were a plane conducting sheet connected to the earth; each line of force from the (+) charge ends normally on this sheet, and since the (+) and (−) ends of a line of force respectively constitute (+) and (−) electrifications, the total (−) charge on the sheet is numerically equal to the (+) charge which induced it. Hence, finally, the field of force due to a given charge placed in the neighbourhood of a large plane conducting sheet which is connected to earth, can be found by supposing the conducting sheet to be removed, while a charge equal but opposite to the given one is placed as far behind the plane of the sheet as the given charge was in front of it. In this case the electric image occupies the position of the optical image produced by reflection in the plane of the conducting sheet.

To find the distribution of charge on the left-hand side of AB, it must be remembered that a charge Q corresponds to the ends of n lines of force, where

$$n = 4\pi Q.$$

This result is derived, as explained in the *Practical Teacher* for April 1906 (p. 584), from the condition that the number of lines of force per square centimetre at any point in the field is equal to the force that would act on unit charge if it were placed at that point. Hence, if we calculate the force that the two opposite charges C and D would exert on a unit charge

placed at any given point of AB, then the force is numerically equal to the number of lines of force per square centimetre passing through the plane AB near the given point. Further, the number of lines of force per square centimetre divided by 4π gives the charge per unit area (or the surface density of the charge) in the neighbourhood of the point, when AB is supposed to be a conducting plane.

Let the charge at C be equal to $+q$, while the distance CD is equal to $2l$. (I assume that $\delta+q$ in the question is a printer's error for $+q$, as the δ would have no significance.) Let E be a point in AB, at a distance r from the point where the straight line joining C and D cuts the plane AB. Then it is easily proved that a charge $+q$ at C together with a charge $-q$ at D produce a field equal to $-2ql/(\mathrm{CE})^3$, where CE denotes the distance of E from C. This result is obtained just as in the case of the magnetic field due to a magnet in Gauss's broadside-on position. Hence, when AB is an earth-connected conducting sheet, the surface density of the charge in the neighbourhood of E is equal to

$$\frac{-2ql}{4\pi(l^2+r^2)^{\frac{3}{2}}}.$$

MATHEMATICS.

(STAGES 2 AND 3.)

BY FRANK CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mathematics, etc., Morley College; Author of "Elementary Practical Physics," "Practical Mathematics," etc.

Solution of Triangles.—In addition to the formulæ already referred to, there is the important case when two sides and an angle are given. The formulæ usually used is

$$\tan\tfrac{1}{2}(\mathrm{B}-\mathrm{C})=\frac{b-c}{b+c}\tan\tfrac{1}{2}(\mathrm{B}+\mathrm{C})$$

$$=\frac{b-c}{b+c}\cot\frac{\mathrm{A}}{2} \quad \ldots\ldots\ldots \quad (4)$$

The two remaining formulæ are easily written down by noting the cyclical arrangement of the letters.

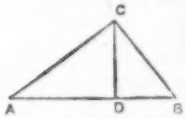
Thus $\tan\tfrac{1}{2}(\mathrm{A}-\mathrm{B})=\dfrac{a-b}{a+b}\cot\dfrac{\mathrm{C}}{2}$

and $\tan\tfrac{1}{2}(\mathrm{A}-\mathrm{C})=\dfrac{a-c}{a+c}\cot\dfrac{\mathrm{B}}{2}$.

The preceding data is usually expressed as, *given two sides and included angle of a triangle*, to find the remaining angles and the remaining side.

It will be noticed that the given triangle may be solved by drawing a perpendicular from an angle to the opposite side; in this manner the triangle is converted into two right-angled triangles.

Thus in the triangle ABC, given the two sides b and c and the included angle A, to find the remaining angles we may proceed to draw from C a line CD perpendicular to AB; then we obtain



$$\mathrm{CD}=b\sin\mathrm{A},\ \mathrm{AD}=b\cos\mathrm{A},$$

and $\mathrm{DB}=\mathrm{AB}-\mathrm{AD}=c-b\cos\mathrm{A}$.

Then B may be found from the relation

$$\tan\mathrm{B}=\frac{\mathrm{CD}}{\mathrm{DB}}.$$

The methods adopted may be seen from the following applications of the formulæ to the solution of a given triangle.

Ex. 1. The difference between the base and the perpendicular of a right-angled triangle is one-fifth of their sum; find the angles. (1902)

Let A denote the right angle. Then from the formula

$$\tan\tfrac{1}{2}(\mathrm{B}-\mathrm{C})=\frac{b-c}{b+c}\cot\frac{\mathrm{A}}{2}$$

we obtain by substitution

$$\tan\tfrac{1}{2}(\mathrm{B}-\mathrm{C})=\tfrac{1}{3}\cot 45^\circ$$

$$\text{or } \mathrm{L}\tan\tfrac{1}{2}(\mathrm{B}-\mathrm{C})=\log 2+\log 1+10-1$$

$$=9{\cdot}3010300.$$

From given tables

$$\mathrm{L}\tan 11^\circ 19'=9{\cdot}3012954$$

$$\text{,, ,, } 18'=9{\cdot}3006383$$

Hence $\tfrac{1}{2}(\mathrm{B}-\mathrm{C})=11^\circ 18' 36''$.

$$\therefore\ \mathrm{B}-\mathrm{C}=22^\circ 37' 12''$$

and $\mathrm{B}+\mathrm{C}=90$;

$$\therefore\ \mathrm{B}=56^\circ 18' 36''$$

$$\mathrm{C}=33^\circ 41' 24''.$$

Ex. 2. Show that in a triangle ABC

$$(b+c)\tan\tfrac{1}{2}(\mathrm{B}-\mathrm{C})=(b-c)\tan\tfrac{1}{2}(\mathrm{B}+\mathrm{C}).$$

Having given $b=105$, $c=55$, find B and C. (1898)

$$\tan\tfrac{1}{2}(\mathrm{B}-\mathrm{C})=\frac{b-c}{b+c}\tan\tfrac{1}{2}(\mathrm{B}+\mathrm{C})$$

$$=\frac{105-55}{105+55}\tan 64^\circ 30'.$$

$$\mathrm{L}\tan\tfrac{1}{2}(\mathrm{B}-\mathrm{C})=\log 5+\mathrm{L}\tan 64^\circ 30'-\log 16$$

$$=\log 10+\mathrm{L}\tan 64^\circ 30'-5\log 2$$

$$=9{\cdot}8163539.$$

$$\therefore \text{ From given tables } \tfrac{1}{2}(\mathrm{B}-\mathrm{C})=33^\circ 13' 54''$$

$$\text{and } \tfrac{1}{2}(\mathrm{B}+\mathrm{C})=64^\circ 30'$$

$$\therefore\ \mathrm{B}=97^\circ 43' 54''$$

$$\mathrm{C}=31^\circ 16' 6''$$

Ambiguous case.—What is usually termed the ambiguous case occurs when the given data consists of two sides and the angle opposite one of the given sides. Thus if the sides a b and the angle A are given, then the value of the sine obtained may be either sine B or sin (180° − B).

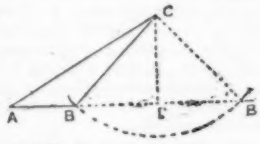
Ex. 3. In any triangle ABC show that

$$\frac{\sin\mathrm{A}}{a}=\frac{\sin\mathrm{B}}{b}=\frac{\sin\mathrm{C}}{c}.$$

If $\mathrm{A}=30^\circ$, $a=3\sqrt{2}$, $b=6$, show that two triangles can be constructed from these data, and find the remaining sides and angles, without using logarithms. (1902)

Draw a horizontal line AB. At A make the angle $\mathrm{BAC}=30^\circ$ and $\mathrm{AC}=6$ units.

With C as centre, radius $3\sqrt{2}$ units, describe an arc. This arc may cut AB in two points, or the two points may coincide, giving a right-angled triangle, the perpendicular CD being C sin A.



$$\therefore\ \mathrm{C}\sin\mathrm{A}=6\sin 30^\circ=3.$$

This is less than a since $3<3\sqrt{2}$, and also less than b; hence there are two triangles

$$\frac{\sin\mathrm{B}}{6}=\frac{\sin 30^\circ}{3\sqrt{2}};$$

$$\therefore\ \sin\mathrm{B}=6\times\frac{1}{2}\div 3\sqrt{2}=\frac{1}{\sqrt{2}};$$

$$\therefore\ \mathrm{B}=45^\circ \text{ or } 135^\circ.$$

$$c=a\cos\mathrm{B}+b\cos\mathrm{A}$$

$$=3\sqrt{2}\times\frac{1}{\sqrt{2}}+\frac{6\sqrt{3}}{2}$$

$$=3(\sqrt{3}+1) \text{ or } 3(\sqrt{3}-1).$$

Ex. 4. Two sides and the included angle of a triangle are given; explain how the remaining parts can be found by dividing the triangle into two right-angled triangles.

In a triangle ABC, given $b=3251$, $c=4793$, $\mathrm{A}=71^\circ 18'$, find the angles B and C by the method indicated above; the dividing line being drawn from C to AB. (1904)

Ans. $\mathrm{B}=39^\circ 23' 11''$, $\mathrm{C}=69^\circ 18' 49''$.

Ex. 5. Show that the sides of a triangle are proportional to the sines of the opposite angles, (*a*) when the angles are acute, (*b*) when one of them is obtuse.

Two sides of a triangle are 600 ft. and 700 ft. in length; and the angle opposite to the shorter side is 37° 36'; draw two distinct triangles which fulfil these conditions, and calculate the remaining parts of that triangle which has an obtuse angle opposite to a given side. (1900)

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Ex. 6. Show by means of a diagram that two triangles can be drawn from the following data, viz., one angle 30°, the opposite side 3 ft., and one of the other sides 4 ft.; also calculate the remaining angles of both triangles. (1902)

Ans. C = 41° 48′ 37″ or 138° 11′ 23″,
B = 108° 11′ 23″ or 11° 48′ 37″.

Ex. 7. (*a*) In a triangle ABC show that

$$(b+c)\sin\frac{A}{2}=a\sin\left(C+\frac{A}{2}\right)$$

and explain how to find the angles of a triangle, when an angle, the opposite side, and the sum of the other two sides are given.

(*b*) In the calculation you have to determine an angle from its sine; show that, though this be the case, the data will give only one triangle.

(*c*) Given that one angle of a triangle is 110°, the opposite side is 5000 units, and the sum of the other two sides 6000 units. Find the remaining angles to the nearest minute. (1905)

Ans. B = 45° 35′ or 24° 25′, C = 24° 25′ or 45° 35′.

CHEMISTRY.

(ADVANCED AND HONOURS.)

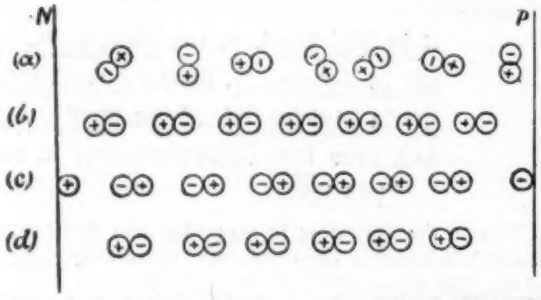
BY C. A. WEST, B.SC., A.R.C.S., F.I.C.

The Conductivity of Electrolytes.

In the November issue of the *Practical Teacher* we saw that the osmotic pressure of a substance in solution was proportional to the molecular concentration of the solute in the solvent. Many exceptions to this rule however occur, notably in the cases of the solutions of strong acids, strong alkalis, and of metallic salts derived from these. We also find that these same substances behave exceptionally with regard to their electrical conductivities when dissolved in water. To explain the reason for this we make use of the dissociation hypothesis.

It will be advisable to compare the more modern view with the older theory of Grotthus, which aimed at explaining the separation of substances brought about in an electrolytic cell. For illustration let us take the case of sodium chloride in solution in water. According to Grotthus's hypothesis each molecule is to be regarded as made up of a sodium ion with a positive charge and a chlorine ion with a negative charge. Under ordinary conditions all the molecules are supposed to be complete, and as many pointing in any one direction as in any other, as partially indicated diagrammatically in line (*a*).

When the positive electrode P is joined to the positive ter-



minal of the battery, and the negative electrode N to the negative terminal, the molecules are constrained to turn with their negative ends pointing to the positive electrode, and the positive ends pointing to the negative electrode, as indicated in line (*b*).

The next action, according to Grotthus, is for the end molecules nearest the electrodes to break up into ions under the influence of the electro-motive force applied to P and N, the negative chlorine yielding up its negative charge to the positive electrode P and the positive sodium yielding up its positive charge to the negative electrode N. The intermediate molecules are supposed to change partners right across the cell as indicated in line (*c*).

According to this view the molecules are actually broken up by means of the electro-motive force applied, hence it would follow that unless an electro-motive force sufficiently great to cause disruption were applied no practical result would be produced; that is to say, none of the molecules would break up and give up their charges, and no current would flow and no electrolysis take place.

This, however, we find does not correspond with observed facts, for experiment shows that Ohm's law holds as strictly for electrolytic solutions as it does for metallic conductors—that is, the current is proportional to the electro-motive force and inversely proportional to the resistance as expressed by the equation

$$C=\frac{E}{R},$$

where C is the current in amperes, E the electro-motive force in volts, and R the resistance in ohms.

No matter how feeble the electro-motive force, electrolysis takes place, and this is in contradiction to Grotthus's supposition.

Clausius has been one of the foremost in developing the new theory of molecular motion, now almost universally accepted. According to his view each molecule is moving in a very irregular manner, being driven hither and thither by the impacts of other molecules which are affected in the same way. This motion goes on at all times whether an electro-motive force is applied or not. It is this motion which causes one liquid to diffuse into another, and the intensity of the motion is increased as the temperature is raised.

While the motion is taking place frequent collisions occur between the molecules, and since the velocities vary the violence of these encounters also varies. Even at low temperatures it is probable that many of the concussions are so violent that some of the molecules are broken up into their components. Each of these ions then wanders about the liquid until it comes into contact with another ion of the opposite kind and unites with it to form a new molecule.

In every liquid, therefore, we suppose that a proportion of the molecules is broken up into ions. The proportion increases with the temperature.

Clausius supposes that the electro-motive force acts on the ions in their intervals of freedom and deflects them slightly from the paths they would otherwise have followed, causing the positive ions to travel on the whole more in the positive than in the negative direction, and the negative ions more in the negative than in the positive direction. The electro-motive force therefore is not regarded as the agent which brings about the disruption of the molecules, but these already taking place whether a current flows or not, it simply directs the ions in their intervals of freedom so that they move towards the electrodes and there causes them to give up their charges. Clausius supposes that as the free ions are removed from the solutions more ions are produced by the encounters of the undissociated molecules.

In this way he accounts for the continuance of the processes of conduction and electrolysis. This hypothesis is sufficient in itself to account for the validity of Ohm's Law in electrolytic solutions.

However, if we wish to go further and explain quantitatively all the observed facts in connection with electrolytic conduction, we may make use of the hypothesis of electrolytic dissociation brought forward by *Arrhenius*. According to Arrhenius, substances which when dissolved cause the solutions to be good conductors of electricity, are almost entirely separated into their constituent ions while those which produce solutions of only feeble conductivity are only split up to a small extent.

Indeed, Arrhenius holds that by means of a determination of the conductivity the amount of dissociation can be ascertained. If only the molecules which are dissociated take part in the conduction of electricity through the cell, it is clear that the conductivity of the solution will depend on two things—the rate of motion of the ions and the degree of concentration of the ions in the solution. In what follows we shall frequently speak of the *molecular conductivity* of a substance.

To get a clear idea of what is meant by molecular conductivity, suppose we have a rectangular vessel, two opposite sides of which are 1 cm. apart. These two sides are of platinum and form the two electrodes, and are of great extent. The two short sides are of non-conducting material, such as glass. Introduce into the vessel so much of the solution that it contains the molecular weight of the solute in grams.

This solution will have a definite resistance which, expressed in terms of Siemens' mercury unit, is called the *molecular resistance* of the substance.

The reciprocal of the molecular resistance is called the molecular conductivity of the substance.

It has been found experimentally by Kohlrausch that the mole-

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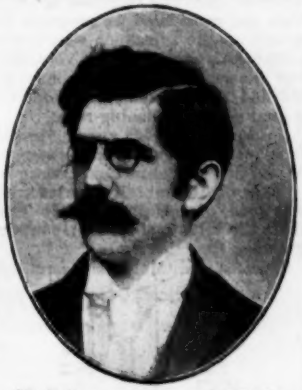

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cular conductivity increases as the dilution is increased. In the case just considered we supposed that the molecular weight in grams of the substance was dissolved in a certain volume of solvent. If we double the volume by adding water, we find that the molecular conductivity increases. On diluting still further we find that the molecular conductivity still increases, but at a gradually diminishing rate.

In the case of good conductors this goes on until a maximum is reached, when adding water produces no further change. With bad conductors a maximum is never reached.

Some of Kohlrausch's figures are given below for a number of solutions of metallic salts. The first column expresses in litres the volume of solution containing the molecular weight in grams of the substance.

Dilution = v. Molecular conductivity = u.

v.	u.		
	Na Cl.	K Cl.	Li Cl.
1l	69·5	91·9	59·1
10l	86·5	104·7	77·5
100l	96·2	114·7	87·5
1000l	100·8	119·3	92·1
10,000l	102·9	120·9	94·3
50,000l	102·8	121·7	95·5
100,000l	102·4	121·6	96·5

This table shows that the maximum is attained in these cases at a dilution somewhere between 1000l and 10,000l, the differences in the figures for higher dilutions being probably due to experimental error.

Kohlrausch also found that almost without exception the molecular conductivity increased with rise in temperature, and generally at the rate of about 2 per cent. per degree Centigrade.

PHYSIOGRAPHY.

(STAGES 2 AND 3.)

ENERGY.

FOR centuries the question of the possibility of discovering a source of perpetual motion which could be utilised for doing work has claimed the attention of many inventors and experimentalists, and numerous claims have been made that the problem has been solved, but on investigation none of the claims have been substantiated.

We know from our everyday experience that in order to do work we have to use force. It is true that in many cases we need not apply the force continually; for instance, after winding up a clock it will continue to go for a considerable time, but unless we rewind it at intervals it will stop after a time.

Of course, the fact that a machine has not yet been invented which without a supply of energy from outside will continue to do work indefinitely, is no proof that it is impossible to invent such a machine; but a study of the various forms of energy and the laws which energy seems to obey leads us to conclude that such a machine is an impossibility.

In order to enable us to get definite ideas of what we mean by energy and work, let us agree to take as our unit of work the amount of work which must be done on a mass of one gram to raise it against the force of gravity through a distance of one centimetre in vacuo. It is necessary for our purpose to suppose that the body is in vacuo, because this affects the amount of work which we have to do. For instance, suppose the material is cork, and the medium by which it is surrounded water, then we should have to do no work to raise the cork through a distance of one centimetre; in fact, we should have to do work to force the cork downwards.

Now, taking the above as our unit of work, it is quite evident that in order to raise a mass of one gram through a distance of two centimetres we shall have to do two units of work; to raise it through three centimetres, three units, and so on; and generally to raise a mass of m grams through a distance of d centimetres we shall have to do $m\,d$ units of work.

Next consider the action of gravity in producing velocity in a body. Suppose that our unit of time is the second, and that our unit of velocity is the velocity of a body moving at the rate of one centimetre per second. Also, let our unit of acceleration be the production of unit velocity by a force applied for one second.

Now, since the velocity acquired by a body after falling for one second under the action of gravity is 981 centimetres per second, we must denote the force of gravity or g by 981. The distance travelled by the body in the same second will be the same as the average velocity during the time multiplied by the time, that is, $\frac{0+981}{2}\times 1$, or 490·5 centimetres. From this we can readily see that if we projected a mass of one gram vertically upwards with a velocity of 981 centimetres per second, it would rise to a height of 490·5 centimetres—that is to say, before ceasing to rise it would do 490·5 gram-centimetres of work.

Further, we find by experiment that a body falling for two seconds under the action of gravity acquires a velocity of 1962 centimetres per second, and during the two seconds falls through a distance of 1962 centimetres. Hence if we project a mass of one gram upwards with a velocity of 1962 centimetres per second, it will rise to a height of 1962 centimetres, and will therefore do 1962 gram-centimetres of work.

Comparing this with the first case, we see that by doubling the velocity we have enabled it to do four times the work.

In dealing with questions of this kind it will often be found convenient to calculate the distance a body could rise against gravity in order to find the amount of work it is capable of doing.

We may generalise the ideas just explained by expressing them in the form of an equation.

$$\text{Work done by unit mass} = \frac{v^2}{2g}.$$

where v is the initial velocity and g the force of gravity.

If the mass of the body projected is m grams, then the work $= \frac{mv^2}{2g}$.

We take as our unit of force the force which applied to a mass of one gram for one second produces in it a velocity of one centimetre per second. This unit we call the *dyne*. Expressed in terms of this unit we have seen that the force of gravity is equal to 981 dynes. Now suppose the force of gravity to be decreased until it becomes equal to one dyne, then in the equation

$$\text{Work} = \frac{mv^2}{2g}$$

g becomes one and the equation changes to Work $= \frac{1}{2}mv^2$, for since the force to be overcome is now less, the body will rise further.

A body of m grams moving with an initial velocity v against unit force is capable of doing $\frac{1}{2}mv^2$ units of work, and this is due to the energy which it possesses in virtue of its mass and its motion. This energy is called the *kinetic energy* of the body.

Of course, the work done will be the same if the body moves against a force greater than unity, but the distance travelled over will be less.

When the body has risen to its maximum height it has spent its kinetic energy, but it has gained the advantage of an elevated position. The body has now an advantage of position with regard to the force of gravity in virtue of which when it again falls to its original position it will have acquired a velocity equal to the original velocity of projection, and therefore an amount of kinetic energy equal to its original amount of kinetic energy.

The energy which the body possesses in virtue of its position is termed *potential energy*. The body possesses just as much energy when at the summit of its journey as it does when at the starting-point, the difference being that in the former case the energy is all potential energy, and in the latter case all kinetic energy. At any intermediate position the energy is partly potential and partly kinetic, but the sum is always the same, so that throughout the whole path pursued no energy is destroyed or created. There is simply a change of one kind of energy into another.

What is true in the case we have just studied is true in the case of any machine if we disregard losses due to friction, etc. Let us take a lever as one of the simplest types of machine. Suppose one arm to be three times as long as the other. Suppose at the end of the short arm we have a mass of 300 grams, we find that to balance this we require a mass of 100 grams at the end of the long arm. If we wish to lift the larger weight through 10 centimetres we shall have to allow the smaller one to fall through 30 centimetres. The product of the force into the distance is the same in each case—

$$300\times g\times 10 = 100\times g\times 30.$$

We have two factors, space and force, and if we increase one we do it at the expense of the other. We may gain force at the expense of space or space at the expense of force.

In addition to converting kinetic energy into potential energy, and *vice versâ*, we also find that kinetic energy can be converted into other forms, and into some of these various transmutations we will go in another lesson.

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Scamp.—A man has £100,000 for which he receives 3½ % interest and spends £7000 a year. Find in what time he will be ruined, given log 2 = 0·301, log 3 = 0·477, and log 23 = 1·362.
(*Elementary Algebra*, Hall and Knight.)

The question amounts to this:—
If £100,000 is the present value of an immediate annuity of £7000 to continue for n years, what is the value of n, interest being reckoned at 3½ % per annum?
The value of n is given by the formula

$$P = \frac{1-(1+r)^{-n}}{r} \cdot A$$

where P is the present value, A the annual income, r the rate of interest per £1 per annum, and n the number of years.
Hence we have

$$100{,}000 = \frac{1-(1{\cdot}035)^{-n}}{0{\cdot}035} \times 7000;$$

$$\therefore (1{\cdot}035)^{-n} = 0{\cdot}5;$$

$$\therefore -n \log 1{\cdot}035 = \log 0{\cdot}5$$

$$1{\cdot}035 = 23 \times 9 \div 200$$

$$\log 23 = 1{\cdot}362$$
$$\log 9 = 2 \log 3 = 0{\cdot}954$$
$$\overline{2{\cdot}316}$$
$$\log 200 = 2{\cdot}301$$
$$\therefore \log 1{\cdot}035 = 0{\cdot}015$$

$$\log 0{\cdot}5 = \log\left(\tfrac{1}{2}\right) = \log 1 - \log 2.$$

But $\log 1 = 0$, and $\log 2 = 0{\cdot}301$;

$$\therefore \log 0{\cdot}5 = -0{\cdot}301.$$

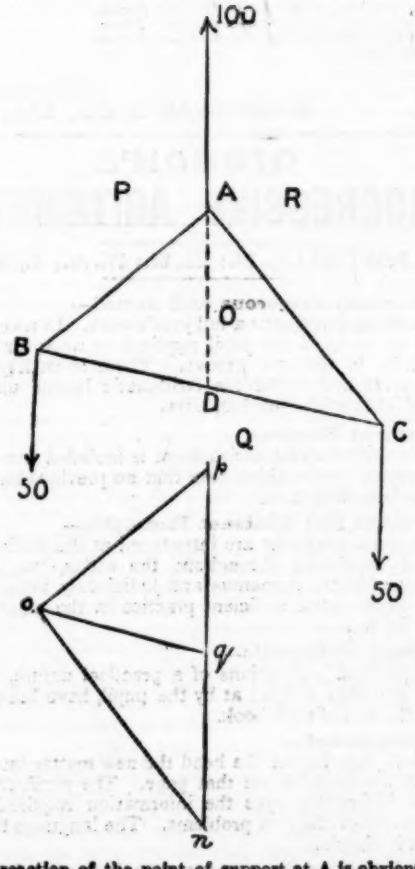
Hence $-n \times 0{\cdot}015 = -0{\cdot}301$;

$$\therefore n = \frac{301}{15} = 20{\cdot}06.$$

The money would therefore last just over twenty years.

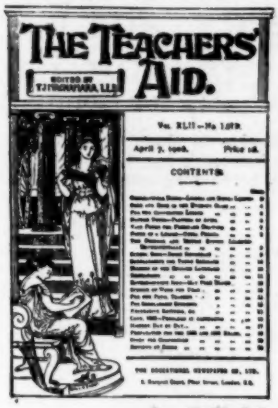
J. B. H.—Consult any modern work on *Higher Trigonometry*. See, for example, Loney's *Trigonometry*, Part II., § 272.

Bike.—BC, CA, AB are three weightless rods formed into a triangular frame; their lengths are respectively 10, 8, 6. The frame is hung up at the angular point A, a weight of 50 lb. is hung at B and 50 lb. at C; find the stresses in BC.



The reaction of the point of support at A is obviously equal to a force of 100 lb. and acts vertically upwards; and since the

NOW READY.



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weights at B and C are equal, the direction of the reaction will pass through D, the middle point of BC.

Take any vertical line rp to represent the reaction at A, and draw po, ro parallel to AB, CA. Draw oq parallel to BC.

Then by the triangle of forces

the forces acting at A are represented by the sides of the triangle rpo,
and " " B " " " " " " opq,
and " " C " " " " " " qro.

Now by the question we have

$$BC : CA : AB = 10 : 8 : 6.$$

Therefore BAC is a right angle.

But ro, op have been drawn parallel to CA, AB; therefore rop is also a right angle.

Again qp is parallel to DA, po to AB, and oq to BD. Therefore the triangle poq is similar to the triangle ABD.

But we have shown that BAC is a right angle, and that D is the middle point of BC. Therefore DA = DC = DB.

But the triangle poq is similar to the triangle ABD. Therefore $qo = qp$.

In the same way we may show that $qo = qr$. But rp represents a force of 100 lb. Therefore qo represents a force of 50 lb.

Hence the stresses in BC are,

a force of 50 lb. acting in the direction BC,
and an equal force acting in the direction CB.

Gosforth.—A rod stands in a vertical position on a rough horizontal plane; if it be slightly displaced, find the reaction of the plane during the subsequent motion before slipping takes place; show that slipping must take place before the horizontal position is reached.

(*Theoretical Mechanics*, Stage 3, 1905.)

Let R be the reaction of the plane at any instant (before slipping begins) when the rod makes the angle θ with the downward vertical through the point of contact. Then if P, Q be the components of R along and perpendicular to the rod, the complete solution of the motion is obtained from

$$\frac{d^2\theta}{dt^2} = -\frac{g\lambda \sin\theta}{\lambda^2 + k^2} \quad \ldots\ldots\ldots (1)$$

$$P = mg\cos\theta + m\lambda\left(\frac{d\theta}{dt}\right)^2 \quad \ldots\ldots\ldots (2)$$

$$Q = mg\sin\theta + m\lambda\frac{d^2\theta}{dt^2} \quad \ldots\ldots\ldots (3)$$

where 2λ is the length of the rod and k is the radius of gyration of the rod about its centre of gravity.

Now in a rod we have $k^2 = \frac{\lambda^2}{3}$, hence (1) may be written

$$\frac{d^2\theta}{dt^2} = -\frac{3}{4}\frac{g}{\lambda}\sin\theta.$$

Integrating we have

$$\left(\frac{d\theta}{dt}\right)^2 = \frac{3}{2}\frac{g}{\lambda}\cos\theta + C.$$

But $\frac{d\theta}{dt} = 0$ when $\theta = \pi$, $\therefore C = \frac{3}{2}\frac{g}{\lambda}$.

Hence $\left(\frac{d\theta}{dt}\right)^2 = \frac{3}{2}\frac{g}{\lambda}(1 + \cos\theta)$.

But $P = mg\cos\theta + m\lambda\left(\frac{d\theta}{dt}\right)^2$;

$\therefore P = \frac{mg}{2}(3 + 5\cos\theta)$.

Also $Q = mg\sin\theta + m\lambda\frac{d^2\theta}{dt^2}$;

$\therefore Q = \frac{mg}{4}\sin\theta$.

Now $R = \sqrt{(P^2 + Q^2)}$;

$\therefore R = \frac{mg}{4}\sqrt{\sin^2\theta + (6 + 10\cos\theta)^2}$;

$\therefore R = \frac{mg}{4}\sqrt{99\cos^2\theta + 120\cos\theta + 37}$ . . . (4)

BRITISH MUSEUM 28 MY 1906

Let ϕ be the angle the resultant pressure R makes with the rod (the angle being measured clockwise from the rod); then

$$\tan\phi = \frac{Q}{P} = \frac{\sin\theta}{6 + 10\cos\theta} \quad \ldots\ldots\ldots (5)$$

Hence (4) and (5) determine the reaction of the plane in magnitude and direction for any position of the rod before slipping begins.

Now N, the component of R normal to the plane, will obviously vanish when $\phi = \theta - 90°$. But the force resisting slipping is μN; thus, whatever the value of μ may be, slipping must occur when $\phi = \theta - 90°$.

But we have shown that

$$\tan\phi = \frac{\sin\theta}{6 + 10\cos\theta};$$

thus when $\phi = \theta - 90°$

$$\tan(\theta - 90°) = \frac{\sin\theta}{6 + 10\cos\theta};$$

$$\therefore -\operatorname{cotan}\theta = \frac{\sin\theta}{6 + 10\cos\theta};$$

$$\therefore -6\cos\theta - 10\cos^2\theta = \sin^2\theta;$$

$$\therefore 9\cos^2\theta + 6\cos\theta + 1 = 0;$$

$$\therefore (3\cos\theta + 1)^2 = 0;$$

$$\therefore \theta = \cos^{-1}(-\tfrac{1}{3}).$$

Hence θ is greater than 90°; that is, slipping takes place before the horizontal position is reached.

Geometry.—The three angles of a triangle are denoted by the letters A, B, C. The angle B is $\frac{2}{3}$ of the complement of C, and the angle C is $\frac{4}{5}$ of the angle A. Find how the angle A and the complement of B are related. (Pinkerton's *Trigonometry*.)

By the question we have

$$B = \tfrac{2}{3}(90° - C)$$

and $C = \frac{4}{5}A$.

But $A + B + C = 180°$;

$\therefore A + \frac{2}{3}(90° - \frac{4}{5}A) + \frac{4}{5}A = 180°$;

$\therefore A + 240° - \frac{8}{15}A + \frac{4}{5}A = 180°$;

$\therefore 240° - A = 180°$;

$\therefore A = 60°$, and $C = \frac{4}{5}A = 72°$;

$\therefore B = 180° - 60° - 72°$;

$\therefore B = 48°$.

The complement of B is therefore $(90° - 48°) = 42°$.

Therefore $A : (90° - B) = 60° : 42° = 10 : 7$.

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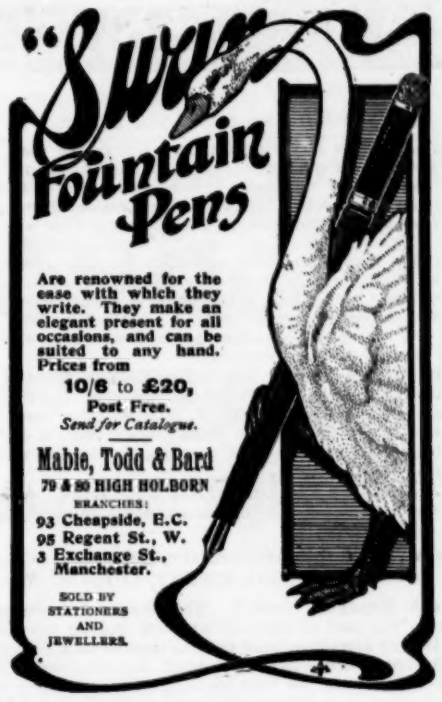

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PRACTICAL TEACHER
June 1906

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